European Commission

Synopsis of RFCS Projects 2017 – 2020

Full list of projects co-financed by the Research Fund for Coal and Steel of the European Union

08 December 2020

Research and Innovation

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839227 (2019)	TGA5	REUSteel	151
800774 (2018)	**TGK2**	**MEGAPLUS**	**38**
800771 (2018)	TGA1	SPARERIB	58
800769 (2018)	**TGA3**	**HIGHSPEEDGALVANIZING**	**81**
800763 (2018)	TGA4	HSSF	120
800762 (2018)	**TGA5**	**ECOSLAG**	**60**
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800689 (2018)	**TGK1**	**I2MON**	**28**
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800679 (2018)	**TGA2**	**RADIFLAT**	**90**
800677 (2018)	TGA5	NEWTECH4STEEL	156

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800649 (2018)	**TGA4**	**WARMLIGHT**	**125**
800644 (2018)	TGA2	PMAPIA	82
800643 (2018)	**TGA1**	**LOWCARBONFUTURE**	**59**
799787 (2018)	TGA4	LIGHTTECH	126
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788552 (2018)	**TGA5**	**QUALITY4.0**	**159**
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754200 (2017)	**TGA1**	**REMOCOAL**	**65**
754198 (2017)	TGA4	TRAFIR	127
754197 (2017)	**TGA1**	**FINES2EAF**	**62**
754186 (2017)	TGA2	NNEWFLUX	84
754185 (2017)	**TGA4**	**HAIR**	**128**
754169 (2017)	TGK1	INESI	30
754155 (2017)	**TGA4**	**STIFFCRANK**	**129**
754144 (2017)	TGA3	NOSTICKROLLS	105
754130 (2017)	**TGA2**	**SUPPORT-CAST**	**85**
754113 (2017)	TGA1	SUPERCHARGEEAF	63
754102 (2017)	**TGA4**	**STEELWAR**	**130**
754092 (2017)	TGA4	GRISPE PLUS	131
754077 (2017)	**TGK1**	**METHENERGY PLUS**	**31**
754072 (2017)	TGA4	LOCAFIPLUS	132
754071 (2017)	**TGA2**	**INFIRE**	**92**
754070 (2017)	TGA4	STEELSECO	106
754064 (2017)	**TGA1**	**OXYMON**	**64**
754060 (2017)	TGK2	COALBYPRO	42
754055 (2017)	**TGA1**	**DUMICO**	**66**
754048 (2017)	TGA4	EQUALJOINTS-PLUS	134
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751583 (2017)	**TGA4**	**STABFI**	**136**
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747266 (2017)	TGA4	INNOFAT	140
745982 (2017)	**TGA4**	**FASTCOLD**	**141**
743504 (2017)	TGA4	STROBE	142
741659 (2017)	**TGK2**	**ESTIVAL**	**40**

Technical Group Coal 1

Post-mining issues, safe and productive coal mining operations

The scope TGK1 includes:

- Highly efficient, largely automated excavation and mining technologies
- Health and safety in coal mining operations
- Upgrading coal deposits; (enhanced) coal bed methane, underground coal Gasification
- Support technologies and services, transport systems and monitoring & process control systems
- Reduction of the environmental impact of mining
- Post-mining environmental issues and land rehabilitation, including energy projects
- Waste management

899192 (2020)	**PostMinQuake** *Induced earthquake and rock mass movements in coal post mining areas : mechanisms, hazard and risk assessment*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 2,722,577.75	Start Date	01/09/2020
	EU Contribution	€ 1,633,546.65	End date	31/08/2023

Abstract

The management of the post mining regions in Europe is important issue for the safety and economic reasons. The PostMineQuake treats the most important hazard related to unexpected ground motions. They may affect the surface stability, vulnerable structures and critical infrastructures.

The main objective of the proposal is to deepen the knowledge of post-mining seismic events in relation to surface deformations, plans for long term monitoring of post mining lands, shaking-maps of the fluid-induced seismicity of European countries with coal mining legacy, transnational guidelines how to deal with and mitigate a hazard manifesting as seismic tremors in post mining regions.

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899278 (2020)	**TRIM4Post-Mining** *Transition Information Modelling for transition from coal exploitation to a re-vitalized post-mining land*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 2,377,681.90	Start Date	01/08/2020
	EU Contribution	€ 1,426,609.14	End date	31/07/2023

Abstract

TRIM4Post-Mining brings together a consortium of European experts from industry and academia to develop an integrated information modelling system. This is designed to support decision making and planning during the transition from coal exploitation to a re-vitalized post-mining land scape enabling infrastructure development for agricultural and industrial utilization and also to contribute to recover energy and materials from coal mining dumps. The proposed approach allows for efficient and transparent communication of planning options and associated project risks and opportunities between all key stake holders. It will be founded up on a high-resolution spatio-temporal data-base utilizing state-of-the art multi-scale and multi-sensor monitoring technologies that characterize dynamical processes in coal waste dumps related to timely dependent deformation and geochemical processes. It will develop efficient methods for comprehensive spatiotemporal data analytics, feature extraction and predictive modelling that allow for the identification of potential contamination areas and forecasting the waste dump dynamics. For the interactive exploration of alternative land use planning scenarios in terms of residual risks, technical feasibility, environmental and social impact and also affordability, up-to-date data and models will be embedded in an interactive planning system based on Virtual Reality and Augmented Reality technology forming a TRIM – Transition Information Modelling System.

Coordinator	*Country*	*Scientific person in charge*
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SPECTRAL INDUSTRIES BV	NL	Dr Ad MAAS
XGRAPHIC INGENIEURGESELLSCHAFT MBH	DE	Dr David BUTTGEREIT
TECHNISCHE HOCHSCHULE GEORG AGRICOLA	DE	Dr Stefan MOELLERHEM
EIJKELKAMP SONICSAMPDRILL BV	NL	Dr Harm NOLTE

899336 (2020)	ROCCS *Establishing a Research Observatory to unlock European Coal seams for Carbon dioxide Storage*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 2,031,355.80	Start Date	01/09/2020
	EU Contribution	€ 1,218,813.48	End date	31/08/2023

Abstract

ROCCS will conduct an in-situ test to evaluate the benefits of enlarging the coal-CO2 contact area to improve rates of CO2 storage. This is a current need based on the constrained CO2 injectivity experienced in tests performed to date due to CO2-induced coal swelling. A test facility will be established at Experimental Mine Barbara (EMB), Mikołów, Poland. CO2 injection will be performed using a horizontal well with an in-seam length significantly larger than in past tests and zonal isolation to control the coal-CO2 contact area. It is hypothesised that past tests have not overcome coal swelling by failing to establish an effective flow connection to the natural fracture network of the coal seams. The coal-CO2 contact area will be increased in stages to determine a relationship with injectivity and evaluate the role of preferential flow pathways. Environmental monitoring will provide insights into the gas flow regime. Laboratory tests will use coal samples taken from EMB as well as from a deep coal deposit selected by the ROCCS industrial partner, advancing the state-of-the-art by using intact cores that are significantly larger than those conventionally used, with pressure measurements along the flow axis and a near zero-displacement boundary to represent the in-situ condition. Numerical modelling will be applied to design the in-situ test and investigate near-field heterogeneity and regional hydromechanical effects. Techno-economic assessment will optimise the use of horizontal wells for CO2 storage for operation at minimum costs. Findings will be implemented for the selected deep coal deposit through the design and evaluation of a commercial scale CO2-storage unit using horizontal wells. Project synthesis will determine whether designing for a larger coal-CO2 contact area is an effective method to improve the rate of CO2 storage, leading to new best practice guidelines.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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POLSKA GRUPA GORNICZA SA	PL	Mr Bartłomiej BEZAK

899469 (2020)	**HEET II** *Innovative high efficiency power system for machines and devices, increasing the level of work safety in underground mining excavations*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 3,087,752.90	Start Date	01/07/2020
	EU Contribution	€ 1,852,651.74	End date	30/06/2023

Abstract

The aim of the HEET II project is to improve labour standards of miners and energy safety in the mines as well as other industries and public services. Four main issues implemented in the project (single-wire energy transmission, wireless energy transmission, monitoring, management and communication, integrated composite monorail route) definitely provide an innovative solution for a highly efficient and safe electricity transmission system. The newly developed components in the HEET II will improve safety by minimizing electric shock hazard and by increasing reliability of the electricity network especially with regard to the reduction of energy costs and capacity of batteries. HEETII is focused on developing and testing the state-of-the-art systems for powering machines and devices, mainly operating in potentially explosive atmospheres, such as coal mines. The newly developed system will consist of four critical subsystems, which can be used together or independently. The area of application of the proposed solutions is very wide and also includes public transport. Two of the subsystems will concern high-efficiency transmission of electric energy. The energy transmission will be based on single-wire and wireless technologies developed by the consortium members. The purpose of single-wire technology will be to supply energy between a power supply and distribution points, reducing the number of cables and especially the wires in cables, taking into account the reduction of their cross-section. In addition, by using single-wire technology, the risk of electric shock to employees will be minimized. The purpose of wireless electricity transmission technology will be to continuously recharge mobile batteries in transportation devices moving on a route, like suspended rail. The technology developed in this project will therefore extend the working time of such devices, which is currently limited by the energy stored in the battery in a single charge. The technology will also enhance safety significantly by eliminating the need to route cables and disassemble and recharge the batteries, as is the current practice. Since the suspended rail will be used as one of the elements of the energy transmission system, it will be another of the subsystems bringing added value in the project. The purpose of the integrated roadway will be to enable wireless transmission of energy to a receiver located in a mobile device (moving on a suspended rail) and to enable on-line monitoring of electrical and environmental parameters responsible for the HEET II system's safety. The rail will be made of composite materials, which will enable reduction of its mass while maintaining the parameters of mechanical strength. The last subsystem of the HEET II system will be the monitoring and control system of the power supply network. The purpose of this subsystem will be to record online the electrical parameters of the power supply network, data sent from the mobile machine receiver and environmental parameters. The results will be analyzed on-line and sent to processing stations. From the information it obtained, subsystem will manage the distribution of electricity, increasing energy efficiency of the mine network by minimizing interruptions in energy supply. In order to achieve planned result, the HEET II project will develop and implement a new sensor network that will be integrated into the roadway and energy transmission subsystems. Integration of individual subsystems at the test stand will allow conducting tests in experimental mine. Obtaining a positive result from tests in the experimental mine it will allow to carry out the certification process and subsequent implementation of the HEET II system in the hazardous areas, like underground coal mines.

Coordinator	*Country*	*Scientific person in charge*
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899512 (2020)	RECPP *Re-purposing Coal Power Plants during Energy Transition*			
Info	Type of Project	Accompanying measures	Duration (months)	24
	Total Budget	€ 1,342,072.20	Start Date	01/07/2020
	EU Contribution	€ 1,342,072.20	End date	30/06/2022

Abstract

The proposal is a Study about the status, the mapping and screening of the re-purposing potential of coal power plants (coal regions in transition - countries, type, age etc). Common assets (specific site assets) and common commitments (PPAs, steam supply to nearby industry, mines etc) have to be taken into account.

One main objective in this part is the collection and systematization of data based on a set of preconditions for sustainable use of assets of coal power stations in the process of phasing out for further investigation of the best sustainable approach for re-purposing of their infrastructures. A strategic and essential number of typical power plants should be selected based on that.

Sustainable solutions for infrastructure re-uses are listet up and described, regarding their boundary conditions and with concern to circular economy and sector coupling approach (site specific solutions like energy production with renewables, geothermic energy production, H2 item, thermal energy storage using existing infrastructure, etc) to asses savings for infrastructure (assets, staff,etc) re-use.

At the end the sites specified and clustered should be matched with the available technologies for repurposing of sites. Technology may be suitable for a certain site or number of sites if the criteria like legal issues, technical issues and market perspectives are fulfilled.

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899518 (2020)	MINRESCUE *From Mining Waste to Valuable Resource: New Concepts for a Circular Economy*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 3,185,067.25	Start Date	01/09/2020
	EU Contribution	€ 1,892,815.35	End date	31/08/2023

Abstract

MINRESCUE aims to address one of the major challenges of coal mining industry in Europe: developing innovative concepts for managing, recycling and upcycling waste geomaterials generated by coal mining activities across Europe. The problem of Coal Mining Waste Geomaterials (CMWGs) is particularly important as the volume of disposed waste is enormous. The core objective of the project is to develop and validate a strategy to upgrade CMWGs as constituents in sustainable construction materials and products. Hence, with significant money saving and environmental footprint reduction, MINRESCUE will significantly contribute to the establishment of a circular economy in coal mining areas.

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DTEK ENERGY LIMITED LIABILITY COMPANY	UA	Mr Aleksey ZHUKOVSKIY
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POLSKA GRUPA GORNICZA SA	PL	Bartłomiej BEZAK
BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES	FR	Dr Stephanie MULLER
POLITECNICO DI MILANO	IT	Prof Liberato FERRARA
NUOVA TESI SYSTEM SRL	IT	Mr Federico MARCHETTI
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847338 (2019)	**DD-MET** *Advanced methane drainage strategy employing underground directional drilling technology for major risk prevention and greenhouse gases emission mitigation*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	13
	Total Budget	€ 5,217,586.55	Start Date	01/07/2019
	EU Contribution	€ 1,440,074.54	End date	31/12/2022

Abstract

The primary objective of the proposed project is to demonstrate application of long reach underground directional boreholes drilled above mined coal seams as a novel methane drainage technology in longwall mining of coal. The project aims at demonstration of alternative methane drainage technology (not used in Europe) which will contribute to increased mine safety and productivity, reduction of methane emissions and hazards mitigation costs. The project will be conducted in Poland and in Russia. The implementation of proposed technology will be supported by research (laboratory experiments, numerical modelling and extensive field testing) to assure adjustment to field conditions and technology optimisation. The aim of performing two field pilots in different geological and mining conditions of largest Polish and Russian hard coal basins will provide the opportunity to compare the results of individual tasks and will make this technology even more credible and universal. Project will develop a cost effective and environmentally friendly technology to perform methane drainage during coal seam exploitation using in-mine directional drilling replacing very expensive methane drainage galleries developed above mining coal panels, as well as other auxiliary methane drainage methods. The project assumptions will be confirmed in the field and, as a result, best practices will be derived, which will cover technical, technological, environmental and economic aspects, which should be considered in decision making for implementation of proposed drainage technology.

Coordinator	*Country*	*Scientific person in charge*
INSTYTUT NAFTY I GAZU - PANSTWOWY INSTYTUT BADAWCZY	PL	Dr Grzegorz LEŚNIAK
Partners		
GLOWNY INSTYTUT GORNICTWA	PL	Dr Jacek SKIBA
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POLSKA GRUPA GORNICZA SA	PL	Dr Grzegorz PLONKA
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FEDERAL STATE BUDGETARY INSTITUTION OF SCIENCE INSTITUTE OF COMPREHENSIVE EXPLOITATION OF MINERAL RESOURCES RUSSIAN ACADEMY OF SCIENCES	RU	Dr Alex SHLYAPIN

847299 (2019)	RAFF *RISK ASSESSMENT OF FINAL PITS DURING FLOODING*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 3,417,553.95	Start Date	01/06/2019
	EU Contribution	€ 2,050,532.37	End date	31/05/2022

Abstract

The RAFF project aims to research issues related to pit lakes, which is one of the most common uses of post exploitation voids. Up to now, in Europe, there is no precedent for the creation of a pit lake of a brown coal open pit mine of the volume c.a. 1,5 billion cubic meters. There are many examples of flooded smaller final pits and in some of these, during the process of filling with water, serious geotechnical problems have been encountered. It is expected that during reclamation of open pits of volume 1,5 billion m3 the scale of geotechnical problems will be significant and may impede the process of filling the voids with water.

Almost all such artificial lakes are currently (and in the future) dedicated to recreational purposes. To ensure safe utilization of these localities by the public, it is necessary to assess the risk of instability of these areas, and evaluate the long-term monitoring. The main objectives for monitoring the abandoned open-pit mines are: geotechnical stability of the close vicinity and especially the slopes (both under the water level and the final slopes around the lake); the quality of water (chemical composition), not only in the lake itself but also in the close vicinity and all water feeding into the lake.

The main aims of the project are connected with the creation of comprehensive models that can be used for risk assessment purposes. Innovative outcomes of the project will contribute to methodologies and guidelines to improve the safety, security, and environment aspects of flooded open pit mines. The project will carry out in-situ investigation, laboratory tests, and numerical and physical modelling to achieve the objectives.

Thirteen deliverables are planned to be developed within the RAFF project, especially methodologies, numerical models and guidelines.

Coordinator	*Country*	*Scientific person in charge*
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CTL MACZKI-BÓR S.A.	PL	Mr Sławomir RZEPECKI
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SOCIETATEA COMPLEXUL ENERGETIC OLTENIA SA	RO	Dr Ionut PREDOIU

847253 (2019)	**BUSDUCT** *Increase of mines efficiency and health protection through the innovative transport system based on BUSDUCT*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,900,159.90	Start Date	01/06/2019
	EU Contribution	€ 1,140,095.94	End date	30/11/2022

Abstract

The transport routes in mines are becoming longer in a result of need to reach the coal seams, which are more and more distant from the shaft, thus efficient transport system is very important for the effective functioning of mines. Widely used transport systems based on suspended locomotives, powered by diesel engines, provides a speed up to 2m/s. Furthermore diesel locomotives are onerous due to exhaust gases and heat emission in confined space. Limited speed extends the exposure time of miners to exhaust gases and results in a significant shortening of their effective worktime. Development of innovative mine transportation system based on three-phase busduct, integrated with the suspended monorail track, for powering the suspended locomotives, is the project objective. Possibility of using the busduct system in the coal mining industry in workings of “a”, “b” or “c” degree of methane explosion hazard and in workings of “A” or “B” class of coal dust explosion hazard is the main innovation. Current collectors which contacts with busduct at speed over 4 m/s, has to be isolated from the mine atmosphere. For that purpose inerting of the power collector working zone within the busduct by inert gas is planned, preventing against ingress of explosive atmosphere. Special nitrogen agregate subassebly of the suspended locomotive, is planned to be developed for this purpose. Operation of the current collectors of the suspended locomotive will be controlled by a series of sensors. It is planned to apply several levels of safety of current collectors operation, eliminating the possibility of explosion ignition. The following factors guarantee stable market demand for the new product: • necessity of using the effective transportation systems in mines, • disadvantages of present systems due to emission of exhaust gases and heat, • advantages of the new transport system, especially health protection, higher transportation speed and lower energy consumption.

Coordinator	*Country*	*Scientific person in charge*
INSTYTUT TECHNIKI GORNICZEJ KOMAG	PL	Dr Andrej DRWIEGA
Partners		
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POLSKA GRUPA GORNICZA SA	PL	Mr Rafał GĄSIOR
RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Dr Thomas BARTNITZKI
BARTEC VARNOST	SI	Mr Asic RUDI

847250 (2019)	**TEXMIN** *The impact of EXtreme weather events on MINing operations*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 3,076,469.90	Start Date	01/06/2019
	EU Contribution	€ 1,845,881.94	End date	31/05/2022

Abstract

Whilst extreme weather events that are consequence of climate change has been a well-researched subject for many years, it is only recently that the subject has appeared on the radar of the international mining industry. Some mines have already faced issues relating to increased severe weather events so this issue needs to be addressed. The scenarios of climate change indicate that this types of events will be more frequent and violent.

TEXMIN project will identify and evaluate environmental impacts on operating, closed and abandoned mines caused by short term increases in extreme weather events and long-term climate change. Climate change scenarios will be calculated from regional climate models and climate baseline review. Impacts brought about by increases in precipitation, temperature and sudden changes in atmospheric pressure will be identified and evaluated with respect to mines across Europe. These will focus on issues such as minewater, gas emissions and structural stability. Risks will be assessed, adaptation & monitoring strategies and tool will be proposed and developed to mitigate current and future impacts. Some of the remedial actions proposed for shafts and spoil dumps will be applied and tested in pilot scale.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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DMT GMBH & CO. KG	DE	Dr Christoph KLINGER
VYZKUMNY USTAV PRO HNEDE UHLI AS	CZ	Dr Petr SVOBODA
SPOLKA RESTRUKTURYZACJI KOPALN SA	PL	Mr Adrian WINKLER
TAURON WYDOBYCIE SPOLKA AKCYJNA	PL	Mr Rafał PRZYSTAŚ

847227 (2019)	**SUMAD** *Sustainable Use of Mining Waste Dumps*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 3,370,664.65	Start Date	01/07/2019
	EU Contribution	€ 2,022,398.79	End date	30/06/2022

Abstract

The SUMAD project unties European experts to investigate the future use of made-ground consisting of coal-mining spoil with a focus on the geotechnical, sustainability, environmental, socio-economic and long-term management challenges.

Advanced risk analysis and physical and numerical modelling will be applied to different sustainable rehabilitation schemes with a particular focus on the technical viability for the development of renewable energy infrastructure. Tip operators and developers as well as authoritative bodies involved in the project will provide valuable input to ensure the maximum possible impact. A case-study site will be used as a test-bed for the concepts developed during the project.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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GLOWNY INSTYTUT GORNICTWA	PL	Mr Aleksander WRANA
LUBELSKI WEGIEL BOGDANKA SA	PL	Dr Łukasz HEREZY
PUBLIC POWER CORPORATION S.A.	EL	Dr Christos ROUMPOS

847205 (2019)	**RECOVERY** *RECOVERY of degraded and transformed ecosystems in coal mining-affected areas*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 1,980,327.10	Start Date	01/07/2019
	EU Contribution	€ 1,188,196.26	End date	30/06/2023

Abstract

RECOVERY project focuses on land rehabilitation and ecological restoration of coal mining-affected areas, aiming to accelerate the recovery of degraded and transformed ecosystems to a good ecosystem status. It will assess the contribution of these ecosystems to human wellbeing by means of the "ecosystem-services" concept, evaluating the consequences of alternative courses of action in order that their capacity to provide benefits to society will not be diminished.

To achieve these goals, the major aim of the project is to increase the impact of rehabilitation and ecological restoration actions on society and environment, demonstrating the opportunities to improve overall public welfare.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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HUMBOLDT-UNIVERSITAET ZU BERLIN	DE	Prof Dagmar HAASE
VYSOKA SKOLA BANSKA - TECHNICKA UNIVERZITA OSTRAVA	CZ	Prof Barbara STALMACHOVÁ
HULLERAS DEL NORTE SA	ES	Dr Noel CANTO TOIMIL
TAURON WYDOBYCIE SPOLKA AKCYJNA	PL	Dr Robert FRĄCZEK
PALIVOVY KOMBINAT USTI, STATNI PODNIK	CZ	Ms Eva STOUPOVÁ

800711 (2018)	**PICTO** *Production Face Environmental Risk Minimisation in Coal and Lignite Mines*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 2,467,612.10	Start Date	01/09/2018
	EU Contribution	€ 1,480,5670.26	End date	31/08/2021

Abstract

The main objective of the PICTO project proposed is to develop an ICT system to eliminate or minimise undesired and unplanned production stoppages due to increased gas emissions at coal faces through the use of Integrated production process and environmental monitoring and control systems". The project objective will be achieved through:

• Systematic testing and monitoring of underground gas emission and ventilation conditions at faces and numerical modelling to optimise face monitoring and environmental control designs.

• Systematic monitoring of gas drainage performance of drainage boreholes and numerical modelling to optimise face and tailgate gas monitoring and environmental control designs

• Development of an ICT software tool and demonstration of the control procedures.

Coordinator	*Country*	*Scientific person in charge*
INSTYTUT MECHANIKI GOROTWORU - POLSKIEJ AKADEMII NAUK*IMG PAN	PL	Prof. Jerzy KRAWCZYK

Partners		
GLOWNY INSTYTUT GORNICTWA	PL	Prof. Eugeniusz KRAUSE
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EICKHOFF BERGBAUTECHNIK GMBH	DE	Dr Karl-HEINZ RIESER
PREMOGOVNIK VELENJE DD	SI	Dr Janez ROŠER
POLSKA GRUPA GORNICZA SP Z OO	PL	Mr Jacek DZIURA

800757 (2018)	**HYDROCOAL PLUS** *Development and demonstration of Hydro Borehole Technology to improve the competiveness of brown coal excavating techniques worldwide and to minimize their environmental impact.*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	42
	Total Budget	€ 2,455,582.00	Start Date	01/06/2018
	EU Contribution	€ 1,227,791.00	End date	30/11/2021

Abstract

The primary objective of proposed project is to demonstrate Hydro Borehole Mining Technology and develop prototype, novel hydro-mining tool, which will contribute to the competitiveness of brown coal excavation techniques worldwide and address such environmental hazards during and after mine operation like: storage of waste material from overburden removal, preventing the ground level subsidence, keeping undisturbed the level of potable water resources in the ground. The project aims to: investigate the potential for implementation of hydro borehole brown coal mining technology in the industrial scale, analyze the roof stability using the backfilling, calculate its economics, determine environmental impacts and risks. HydroCOAL Plus project's objectives drew attention of the largest European brown coal producers like: Polish Energy Group Mining and Conventional Power Generation joint stock company (PGE GiEK), Czech Severočeské doly a.s. (SD), which confirm pertinence and importance for the industry of project aspects. Above partnership guaranties direct dissemination of project results among leading European industrial partners. HBM-technology is considered to be applicable in deposits, which are either sterilised due to environmental concerns, unmined due to mine design limitations and mine closure requirements and what is even more common - in numerous cases, where significant brown coal deposits are covered by previously removed overburden. HBM technology has a number of advantages comparing with conventional opencast mining in such domains like: safety- it practically excludes human from the coal extraction process, minimal environmental impact, small work force, selectivity, low capital and operating costs, universal applicability. Above advantages provide HBM technology highest level of innovative value in coal mining - largest European brown coal producers confirm this.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
PGE GORNICTWO I ENERGETYKA KONWENCJONALNA SPOLKA AKCYJNA	PL	Mr Ryszard FRANKOWSKI
POLTEGOR INSTYTUT INSTYTUT GORNICTWA ODKRYWKOWEGO-POLTEGOR INSTITUTE INSTITUTE OF OPENCAST MINING	PL	Dr Jacek SZCZEPIŃSKI
TECHNISCHE UNIVERSITÂT BERGAKADEMIE FREIBERG	DE	Prof. Carsten DREBENSTEDT

800689 (2018)	I2MON *Integrated Mining Impact Monitoring*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 2,225,344.60	Start Date	01/07/2018
	EU Contribution	€ 1,353,206.76	End date	30/06/2022

Abstract

i2MON joins highly recognized European institutions to develop an integrated monitoring service for identification and assessment of ground and slope movements related to coal mining. The service comprises innovative monitoring tools including terrestrial laser and radar technology as well as space- and airborne remote sensing. To understand the physical movement processes and in order to minimize mining impact, extensive predictive modelling will be directly integrated with the monitoring information. Finally merged into an integrated web-based system the service will substantially improve monitoring quality and costs and deliver the mining industry a key evaluation and decision making instrument.

Coordinator	*Country*	*Scientific person in charge*
DMT GMBH & CO. KG	DE	Dr Karsten ZIMMERMANN
Partners		
EFTAS FERNERKUNDUNG TECHNOLOGIETRANSFER GMBH	DE	Dr Andreas MÛTERTHIES
INSTYTUT MECHANIKI GOROTWORU - POLSKIEJ AKADEMII NAUK*IMG PAN	PL	Prof. Krzysztof TAJDUS
TECHNISCHE UNIVERSITEIT DELFT	NL	Dr Phil VARDON
HOSCHULE MAINZ UNIVERSITY OF APPLIED SCIENCES	DE	Dr Jörg KLONOWSKI
TECHNISCHE UNIVERSITAET BERGAKADEMIE FREIBERG	DE	Prof. Joerg BENNDORF
LASERDATA GMBH	AT	Mr Frederic PETRINI
LAUSITZ ENERGIE BERGBAU AG	DE	Mr Frank HOFFMANN
AIRBUS DEFENCE AND SPACE GMBH	DE	Dr Oliver LANG
POLSKA GRUPA GORNICZA SA	PL	Mr Bartlomiej BEZAK

754205 (2017)	ROCD *Reducing risks from Occupational exposure to Coal Dust*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 3,400,906.25	Start Date	01/07/2017
	EU Contribution	€ 2,040,543.75	End date	30/09/2020

Abstract

Despite international efforts to limit worker exposure, coal mine dusts continue to impact the health of thousands of miners across Europe. Modern, practicable assessment tools and devices are urgently needed to improve risk models, control dusts and protect workers, particularly from the fine fraction (PM2.5) which is increasingly implicated in human disease. These issues will be addressed through 5 integrated work packages by a world-leading interdisciplinary consortium of 10 institutions from 5 European countries. Global dissemination of developed protocols and training modules, and production of new monitoring and suppression devices will greatly reduce incidences of coal mining-related disease.

Coordinator	*Country*	*Scientific person in charge*
THE UNIVERSITY OF EXETER	UK	Dr Benedict WILLIAMSON

Partners		
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JASTRZEBSKA SPOLKA WEGLOWA SA	PL	Mr Kamil DEBOWSKI

754169 (2017)	**INESI** *Increase Efficiency and Safety Improvement in Underground Mining Transportation Routes*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 2,634,755.25	Start Date	01/07/2017
	EU Contribution	€ 1,550,725.65	End date	30/09/2020

Abstract

There has been a rapid development of auxiliary transportation systems in the European mines in the last two decades. It mainly concerned the solutions, in which the auxiliary transportation means were equipped with their own drives. It has been observed that at the same time the length of tracks on which people are transported is all-time extended. Such situation leads to reduction of effective work time of miners during one shift. There is also a necessity to equip people and equipment/material with tracking systems in dangerous environments. The main objectives of INESI "Increase Efficiency and Safety Improvement in Underground Mining Transportation Routes" project are as follows: increasing the speed and safety of underground auxiliary transportation systems; development and testing of transportation systems adapted to increased speed; elaboration of low energy consumption ventilation of underground transportation routes; development of fully automated system for identification of human's presence on underground conveyors; development of process optimization with persons and equipment tracking.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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PREMOGOVNIK VELENJE DD	SI	Mr Matjaž KAMENIK
DTEK ENERGY LIMITED LIABILITY COMPANY	UA	Mr Aleksey ZHUKOVSKIY

754077 (2017) METHENERGY PLUS

Methane recovery and harnessing for energy and chemical uses at coal mine sites

Info				
	Type of Project	Research	Duration (months)	36
	Total Budget	€ 2,734,327.80	Start Date	01/07/2017
	EU Contribution	€ 1,640,596.68	End date	30/06/2020

Abstract

Methane emissions associated with coal extraction are an environmental and safety risk, but also a potential source of clean energy and chemicals. The scope of the present work is to develop an integrated approach for upgrading this methane in ventilation emissions of working shafts (VAM) as well as those emissions coming from abandoned mines (AMM). This strategy includes the evaluation of concentrations and flow rates in terms of the shaft geological and operational features (working or flooded) and the design of separation processes and chemical reactors, either for methane combustion or for transforming this methane into useful chemicals, such as hydrogen or methanol.

Different strategies are proposed: optimization of the mine operation for providing valuable flow rates and methane concentrations, the development of methane concentration procedures (adsorption, membranes; using nanomaterials with tailored properties); use of advanced reactors and combustion devices (thermal/catalytic reverse flow reactors, membrane reactors, etc.) able to deal with these low concentrations. The final goal of the project is to propose integrated approaches from the optimization of VAM and AMM extraction procedures to the fully upgrading of the methane contained in these streams. For this purpose, the project includes in-situ geological studies, experimentation at lab scale, and computer-aided simulation and optimization processes.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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CHALMERS TEKNISKA HOEGSKOLA AB	SE	Prof. Mats HALVARSSON
SOCIEDAD ASTURIANA DE DIVERSIFICACION	ES	Mr Ruben AVANZAS
POLSKA GRUPA GORNICZA SA	PL	Mr Bartlomiej BEZAK

752504 (2017)	**PRASS III** *Productivity and safety of shield support*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 3,105,889.85	Start Date	01/07/2017
	EU Contribution	€ 1,863,533.63	End date	31/12/2020

Abstract

Deeper and deeper mining of hard coal seams causes that mining crew and equipment are exposed to greater natural hazards. At present progress in the field of automation of mechanized longwall systems does not include monitoring of roof behaviour and preventing against disadvantageous phenomena associated with roof behaviour, such as roof falls to the longwall face or lack of roof fall beyond the shield support leading to local dynamic loading to the working.

It is assumed that by monitoring both shield support behaviour (leg pressures, geometry and tip to face distance) and geotechnical conditions in longwall in real time, warnings about significant improper shield support behaviour and formation of roof instabilities, such as roof cavities/falls or shield closure, will be given several hours in advance. This advance warning allows miners to take preventive action which in turn can reduce longwall downtime and exposure to hazards. Such on-line solutions are not used at present.

Development of Shield Support Monitoring System (SSMS), which will enable monitoring of roof condition in real time, through monitoring the parameters of shield support, as well as development of Longwall Mining Conditions Prediction System (LMCPS) for prediction of roof falls hazards and generation of information about indispensable corrective measures, is the project objective.

LMCPS will be developed on the basis of the geomechanical models and tests of SSMS in real conditions. Geomechanical models are developed from three sources. The physical models, the numerical models (to date with qualitative aspects) and the underground measurement data, which hitherto should not be at variance with the developed theory.

The suggested research work will be undertaken by a well-balanced, interdisciplinary consortium of underground control system developers and manufacturers, shield support designers, mining institutes and mining company complemented by assistance of one University.

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THE UNIVERSITY OF EXETER	UK	Prof. John COGGAN
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Technical Group Coal 2

Environmental, Technical and Economic issues related to Coal treatment and use

The scope TGK2 includes:

- Clean and efficient coal technologies
- Zero-emission and high-efficiency power generation
- Coal gasification and conversion
- Integration of the coal chain from mining to the final products (electricity, heat, hydrogen, coke, synfuels)
- Co-combustion of coal with solid waste or biomass
- Reduction of the environmental impact of installations using coal and lignite
- CO2 capture and storage (CCS)
- Other energy and non-energy uses of coal
- Chemical processing of CO2 captured from combustion or gasification processes and used to produce fuels, petrochemicals and plastics (CCU)

899471 (2020)	**HyCon** *Catalytic Direct Hydrothermal Conversion of Biomass and Lignites to Liquid Fuels and Value-added Chemicals*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 3,038,034.30	Start Date	01/09/2020
	EU Contribution	€ 1,822,820.58	End date	31/08/2023

Abstract

An innovative approach to coal to liquids conversion based on hydrothermal liquefaction (HTL) of biomass feedstocks and high-moisture European lignites is proposed. Building on earlier experiences in HTL, two key properties of water under hydrothermal conditions, water as a reagent donating hydrogen and as a solvent for coal, will be used to produce liquid fuels and value-added chemicals. An intensive experimental programme of batch and continuous catalytic HTL under inert and reactive atmospheres and liquid product upgrading will be carried out to advance technology readiness from the current level of 2 to 5, through independent validation of the process stages and conceptual integration.

Coordinator	*Country*	*Scientific person in charge*
GLOWNY INSTYTUT GORNICTWA	PL	Prof Krzysztof STAŃCZYK
Partners		
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PGE GORNICTWO I ENERGETYKA KONWENCJONALNA SPOLKA AKCYJNA	PL	Mr JerzySAWICKI
ELLINIKA PETRELAIA AE	GR	Dr Spyros KIARTZIS

847333 (2019)	ODYSSEUS *Coal-to-liquids supply chain integration in view of operational, economic and environmental risk assessments under unfavourable geological settings*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 3,307,453.85	Start Date	01/06/2019
	EU Contribution	€ 1,964,060.31	End date	31/05/2022

Abstract

ODYSSEUS aims at Coal-to-Liquids Supply Chain (CLSC) integration and enhanced assessment of operational, economic and environmental risks during or after mine operation in unfavourable geological settings for potential high coal production areas in European medium- to low-grade coal deposits. For that purpose, technological CLSC integration and optimisation are the main project tasks, supported by experimental activities on upgrading coal-derived liquids and by-product beneficiation, integration of conventional and innovative mine development as well as enhanced techno-economic and environmental risk management. Best-practices guidelines and workshops will support decision makers and stakeholders in increasing EU-wide resources utilization and employment, while reducing import dependency.

Coordinator	*Country*	*Scientific person in charge*
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Partners

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DMT GMBH & CO. KG	DE	Dr Torsten GORKA
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PECSI TUDOMANYEGYETEM - UNIVERSITY OF PECS	HU	Dr Maria HAMOR-VIDO
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800774 (2018)	**MEGAPlus** *Unconventional MEthane Production from Deep European Coal Seams through combined Coal Bed Methane (CBM) and Underground Coal GAsification (UCG) technologies*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 2,899,261.70	Start Date	01/06/2018
	EU Contribution	€ 1,739,556.42	End date	31/05/2021

Abstract

MEGA+ aims at evaluation of the use of deep lying methane rich coal deposits for coalbed methane and enhanced coalbed methane recovery using horizontal wells, coupled with subsequent high pressure SNG-oriented UCG through the reuse of the same horizontal wells and permanent storage of CO2. Since, the project takes a radical and holistic approach to coupled CBM-UCG process, beyond state-of-the-art, high-pressure gasification tests, advanced numerical simulations and techno-economic assessments will be developed and employed to investigate site-specific CBM-UCG implementations. Project findings will be compiled in best practices serving as guideline for deep CBM-UCG operations in Europe and world-wide.

Coordinator	*Country*	*Scientific person in charge*
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USTAV CHEMICKYCH PROCESU AV CR, V. V. I.	CZ	Dr Olga SOLCOVA
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POLSKA GRUPA GORNICZA SA	PL	Mr Bartłomiej BEZAK

800659 (2018)	I3UPGRADE *Integrated and intelligent upgrade of carbon sources through hydrogen addition for the steel industry*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 3,319,740.00	Start Date	01/06/2018
	EU Contribution	€ 1,991,844.00	End date	30/11/2021

Abstract

i3upgrade aims at the intelligent and integrated upgrade of carbonaceous by-products in coal conversion industries through hydrogen intensified synthesis processes.

In contrast to established synthesis technologies, the consortium will develop direct methanation and methanol synthesis of coal-based by-product gases in integrated steel works (blast furnace gas, converter gas, coke oven gas) under dynamic and transient conditions. The proposed concept adds hydrogen from an electrolyzer to these CO2/ CO rich gases to adjust stoichiometry and to convert them into intermediate fuels. This reduces the overall coal-based CO2 emissions of the steel work and opens ideal opportunities for balancing the electrical grid. Advanced process control and operational strategies on component-, site- and system level will minimize operational costs and evaluate the thermodynamic and economic performance of the proposed concepts for different market scenarios.

In part A of the proposal, the partners target the development and evaluation of technical key innovations: new reactor concepts for the methanation and methanol synthesis will be characterized for real steel gases under dynamic operation conditions. Part B focuses on the integration and flexible operation of the syntheses within the complete steel production chain based on advanced control concepts. The final proof-of-concept demonstrates the new control strategies and reactor concepts with real bottled steel mill gases as well as with complex gas matrix from an existing coal gasifier, based on transient data from the steel work in Linz, Austria. Agent based modelling of the complete process chain will evaluate the opportunities for reduction of coal-based CO2 emissions in steel works and the benefits to the electric grid in the framework of new emerging volatile markets. The interdisciplinary consortium will elaborate business cases for European steel producers by integrating coal-based steel and synthetic fuel industries.

Coordinator	*Country*	*Scientific person in charge*
FRIEDRICH-ALEXANDER-UNIVERSITAET ERLANGEN NUERNBERG	DE	Prof. Juergen KARL
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AIR LIQUIDE FORSCHUNG UND ENTWICKLUNG GMBH	DE	Dr Holger SCHLICHTING

796585 (2018) Draft	**LIG2LIQ** *Cost Effective Conversion of Lignite and Waste to Liquid Fuels*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,917,063.60	Start Date	01/08/2018
	EU Contribution	€ 1,750,238.16	End date	31/01/2022

Abstract

The aim of this project is to develop an economically efficient concept for production of valuable substances, such as Fischer-Tropsch-fuels or methanol, from lignite and a variety of wastes including plastics and bio-wastes by means of the High Temperature Winkler (HTW) gasification technology. The costs for syngas cleaning are significantly reduced by an innovative acid gas removal stage for the subsequent synthesis step. The work programme starts with lab scale investigations regarding a) the feedstock properties relevant for fluidized bed gasification and b) the development of the acid gas removal stage. Then, the full process chain is tested at real conditions in a pilot plant with a size of 0.5 MWth feedstock input. The process is scaled up to industrial size using adequate models that have been validated at pilot scale. Finally, a techno-economic assessment and life cycle analysis is performed. The results of this project will be used by the project partners to evaluate the ecomomics of the concept and to assess the feasibilty of a future demonstation plant.

Coordinator	*Country*	*Scientific person in charge*
TECHNISCHE UNIVERSITAT DARMSTADT	DE	Dr Jochen STRÖHLE
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UNIVERSITY OF ULSTER	UK	Dr Ye HUANG
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INSTYTUT CHEMICZNEJ PRZEROBKI WEGLA	PL	Mr Grzegorz TOMASZEWICZ
RWE POWER AG	DE	Dr Thorsten LIESE
THYSSENKRUPP INDUSTRIAL SOLUTIONS AG	DE	Mr Ralf ABRAHAM

794369 (2018)	COALTECH2051 *An RFCS Accompanying Measure on European coal research in light of EU policy objectives to 2050 and future global trends in coal use*			
Info	Type of Project	Accompanying Measures	Duration (months)	24
	Total Budget	€ 365,659.50	Start Date	01/07/2018
	EU Contribution	€ 365,659.50	End date	30/06/2020

Abstract

The "energy transition" gives new challenges, but also new opportunities, for exploiting coal in the EU – with lower CO2 emissions.

This Accompanying Measure proposal responds to current EU policy imperatives. It will promote the knowledge gained from the RFCS Research Programme and share experiences with the international research community.

The aim is to develop, with stakeholders, a strategic research agenda for the Programme that is aligned with the EU's Energy Union vision for 2050 and to establish a European Network of Clean Coal Technologists that complements the European Commission's targeted platforms to support the energy transition in the coal regions.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS	EL	Dr Nikolaos KOUKOUZAS

754060 (2017)	**COALBYPRO** *Innovative management of Coal by-Products leading also to CO2 emissions reduction*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,789,858.60	Start Date	01/07/2017
	EU Contribution	€ 1,073,915.16	End date	30/06/2020

Abstract

Coal ash is disposed of or used in different ways depending on: the type of by-product, the processes at the plant and the regulations the power plant has to follow. Some power plants may dispose of it in surface impoundments or in landfills.

Others may discharge it into a nearby waterway under the plant's water discharge permit. Coal ash may also be recycled into products like concrete or wallboard. Coal ash contains contaminants that without proper management, they can pollute waterways, ground water, drinking water, and the air. Therefore, the disposal of the by-products has become an important issue. Considering that coal combustion emits a great amount of CO2, the produced fly ash can be used as a material for on-site CO2 capture and storage (CCS).

In this proposal, a laboratory scale study of mineral carbonation of coal fly ash for CO2 sequestration will be made. The capture of CO2 in the zeolites will also be studied. The two methods (CO2 capture in fly ash and zeolites) will be compared and their carbonated products will be examined in regards to their leachability. The ultimate goal is to be used for the environmental management of coal mines after closure.

Coordinator	*Country*	*Scientific person in charge*
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GLOWNY INSTYTUT GORNICTWA	PL	Prof. Barbara BIALECKA

754032 (2017)	**FLEX FLORES** *Flexible operation of FB plants co-Firing low rank coal with renewable fuels compensating vRES*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,863,691.15	Start Date	01/07/2017
	EU Contribution	€ 1,718,214.69	End date	31/12/2020

Abstract

Main scope of the proposal is the development of new and innovative retrofitting concepts for Circulating Fluidized Beds (CFB) utilizing low rank fuels, allowing them to be more flexible. The proposed concepts are intended mainly for currently operating, not excluding new designed, CFB PPs expected to operate at faster ramp-up rates with an associated low environmental footprint (promotion of co-firing concepts). To meet these objectives, the following actions are foreseen:

• Evaluation and comparison of currently applicable biomass, including crushing and feeding systems, followed by the introduction of a new experimental methodology for the measurement of fuels flowability;

• Materials evaluation for the CFBs refractory lines and the introduction and testing of new super-alloys capable of withstanding the new-demanding flexible at both lab and pilot scale environments and in one industrial site;

• Definition of operational updates, mainly conducted by one of the very well established European CFB manufacturer. Towards this objective, specifications for the basic mechanical components will be derived, while new schemes of operation will be conceptually designed and evaluated in a dynamic mode (e.g. modular heat extraction from boiler, reheat cycles and thermal energy storage) numerically;

• Long-term combustion tests of Greek and German lignite with biomass as co-firing and/or ignition fuel at lab, pilot and industrial scale facilities for different thermal loads;

• CFD and dynamic process simulations for an associate partner utility reference CFB plant;

• Techno-economic and environmental assessment of the proposed concepts when compared to those already done for PFs, followed by business and exploitation plans.

Coordinator	*Country*	*Scientific person in charge*
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PUBLIC POWER CORPORATION S.A.	EL	Mr Papapavlou CHARALAMPOS

741659 (2017)	**ESTIVAL** *ESTImation of coal VALue-in-use in terms of CSR under different carbonization conditions*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,724,560.50	Start Date	01/07/2017
	EU Contribution	€ 1,034,736.30	End date	30/06/2020

Abstract

In addition to the usual characteristics of coals, Coke Strength after Reaction values (CSR) are more and more used in coal trade. The stated values are generally far from the industrial reality and often overestimated through favourable carbonization conditions. Laboratories worldwide use their own devised methodology for coke making, which is cause for concern since CSR results cannot be compared without difficulty. So there is a need to better understand the influence of coal carbonization conditions on coke CSR in order to be competitive in the coal market by means of correct coal value-in-use determination.

Coordinator	*Country*	*Scientific person in charge*
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Technical Group Steel 1

Iron- and Steelmaking

The scope TGA1 includes:

- Ore agglomeration, sintering and pelletising processes
- Physico-chemical metallurgy of liquid steel related to primary/secondary steelmaking and to slag formation
- Optimised sustainable iron- and steelmaking processes and operations (BF, EAF, DRI …)
- New and improved processes for sustainable iron and steel production (hydrogen, electrolysis…)
- New and improved technologies for scrap classification, preparation and recycling for integration in iron- and steelmaking
- Recovery and valorisation of by-products (solids, liquids, gases)
- Instrumentation, modelling, control and optimisation of iron and steelmaking processes
- Reduction of emissions (including CO2), energy consumption and improvement of the environmental impact in iron- and steelmaking processes
- Energy, water and material flow management in iron and steelmaking processes, including recovery of waste heat
- Restoration of steelworks sites

899223 (2020)	**PlasmaPilot** *Flexible Ladle Preheating Procedures using Plasma Heated Refractory*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	42
	Total Budget	€ 1,438,727.55	Start Date	01/07/2020
	EU Contribution	€ 719,363.78	End date	31/12/2023

Abstract

Ladle preheating is a requirement for steelmakers to minimize thermal shock and damage to the refractory lining and to reduce temperature drop of the liquid steel in the ladle. Whereas standard heating technology using flammable gases is unfavorable regarding process efficiency, energy consumption and emissions, a novel technique using plasma heating offers a potential breakthrough in developing flexible ladle preheating procedures through individually plasma heated refractory.

A collaborative pilot and demonstration project involving a steel plant and a plasma heater manufacturer, two European universities and a measurement service provider is proposed to investigate the necessities, technical requirements and opportunities of new ladle preheating procedures using plasma by combining engineering work on adaption of plasma heating to ladle preheating station, numerical modelling of ladle preheating processes using plasma and pilot trials at a plasma heater test rig with a full scale steelmaking ladle. This joint effort aims to test thermal energy input and demonstrate ladle preheating using plasma in operational environment. It is accompanied by numerical studies of effective liquid steel temperature loss of subsequent heat, industrial measurement campaigns and laboratory testing of improved refractory lifetime by minimized decarburization. The project work will be completed by an assessment of economic and environmental benefits and transferability directly into steel plant applications, which would lead to future steel plant implementation.

A future implementation would lead to flexible preheating procedures (drying, first preheating and all subsequent preheating) with increased refractory lifetime from minimized decarburization and wear, minimized emissions during preheating and thus improved working environment, and less gas consumption and higher heating rates.

Coordinator	*Country*	*Scientific person in charge*
KUNGLIGA TEKNISKA HOEGSKOLAN	SE	Prof Björn GLASER
Partners		
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SIDENOR INVESTIGACION Y DESARROLLOSA	ES	Mr Asier ARTEAGA
POLITECNICO DI BARI	IT	Prof Raffaello Pio IAVAGNILIO

899263 (2020)	BLEMAB *BLast furnace stack density Estimation through on-line Muons ABsorption measurements*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,083,972.00	Start Date	01/07/2020
	EU Contribution	€ 1,250,383.20	End date	31/12/2023

Abstract

BLEMAB is the evolution of the previous Mu-Blast project (RFSR-CT-2014-00027).

Building on the successful achievements obtained with the former project, BLEMAB proposal will investigate the imaging capability of the inner zone of blast furnaces, using the muon absorption technique. A new muon detector will be manufactured and then installed at two industrial blast furnace plants. The new detector measurements will be compared with measurements obtained through an enhanced multipoint probe and standard blast furnace models. We expect that the new muon technique will make an essential contribution to the on-line blast furnace process control through the direct detection of the blast furnace cohesive zone.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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899318 (2020)	COACH *Cold-bonded agglomerates for blast furnace ironmaking with chemically engineered binders*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,246,723.45	Start Date	01/07/2020
	EU Contribution	€ 1,348,034.07	End date	31/12/2023

Abstract

The steelmaking activities in Europe rely heavily on the blast furnace BF process for hot metal production. The steelmakers of the COACH consortium (ArcelorMittal, TATA Steel) presently struggle with the need to recycle internal wastes and the need to reduce the CO2 emissions.

The project aims at demonstrating the use of cold-bonded, cement-free, self-reducing agglomerates in blast furnaces. Cold agglomeration is an alternative to sintering and pelletizing processes; it is more energy efficient and generates less CO2.

The agglomerates will be :

- Cement-free to be used in the many European blast-furnaces that do not tolerate further slag addition;

- Self-reducing to reduce coke consumption;

- Made of by-products to improve internal recycling.

This goal will be met with the use of dedicated organic binders.

The lab scale agglomeration and the extensive testing of agglomerates in blast furnace conditions will be followed by pilot scale production and a blast furnace industrial trial.

Coordinator	*Country*	*Scientific person in charge*
CENTRE DE RECHERCHES METALLURGIQUES ASBL	IT	Dr Frédéric BLAFFART
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TATA STEEL UK LIMITED	UK	Dr Martin CIARAN

899415 (2020)	**OnlyPlastic** *EAF working with polymers derived from plastic residue in substitution of fossil fuel*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	36
	Total Budget	€ 2,056,131.30	Start Date	01/09/2020
	EU Contribution	€ 1,028,065.65	End date	31/08/2023

Abstract

ONLYPLASTIC aims to substitute in the Feralpi Lonato EAF all the fossil carbon sources (coal, coke, pet coke), injected and charged as reducing and foaming agent, with densified polymers derived from plastic residue. To reach the optimal use of granulated SRA the following activities are foreseen:

- Realization of a prototypes for granulated SRA handling and transportation
- Realization of a charging system for SRA in the buckets,
- Design of a new injection system customized on the granulated SRA obtained in agreement with UNI 10667-17 specifications
- Investigation of the possibility to inject SRA blended/mixed with other materials,
- perative practices optimization of the process with new materials.

The expected benefits are:

- Natural resources preservation by plastic recycling (circular economy): 100% of coal used in EAF will be substituted
- Reduction of CO2 emission due to:
  - the contribution to iron oxide reduction reaction of the hydrogen contained in the plastic material
  - the reduction of specific electrical consumption (3%)
- Reduction of cost index (lower cost of SRA respect to coal).

Coordinator	*Country*	*Scientific person in charge*
RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Loredana DI SANTE
Partners		
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FERALPI SIDERURGICA SPA	IT	Dr Piero FRITTELLA
I. BLU SRL	IT	Dr Elia GOSPARINI
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847332 (2019)	**Rihanne** *Reliable Blast Furnace Hearth Management*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 3,938,822.95	Start Date	01/06/2019
	EU Contribution	€ 2,363,293.77	End date	30/11/2022

Abstract

The “Rihanne” project focusses on a more reliable blast furnace (BF) hearth management in order to improve the productivity, process stability as well as material and energy efficiency. This is enabled by longer periods between the intermediate hearth repairs, prolonged hearth life time, lower need for extra coke to prevent metal break-out and less deviations from the optimal tapping praxis.

Measurements from innovative on-line devices and comprehensive novel models of lining wear, hearth flow, liquid levels and taphole flow will be integrated via Big Data Methodology to yield straight-forward operator guidelines for smooth and reliable BF hearth operation

The proposed work in Rihanne will be carried out by a consortium of 10 partners from steel making companies, research institutes and universities. This guarantees both the quality of the research and the practical implementation in industry. The research institutes and universities will work in close cooperation with the industrial sites for efficient transfer of data and process knowledge and for implementing the developed tools.

All tasks are divided between the partners in a way to avoid duplication of work, but to benefit from complementary skills and resources. The developed tools will be implemented at one or several blast furnaces. Application of multiple blast furnaces is required for ensuring that the current state-of-art is utilised and that the methods are generally applicable, but also to compare different technologies to determine the best practice.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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UNIVERSITEIT VAN AMSTERDAM	NL	Dr Rudolf SPRIK
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Mrs Sophie CLAIRAY
SSAB EMEA AB	SE	Mr Bo SUNDELIN

847322 (2019)	**TACOS** *Towards A zero CO2 Sintering*			
Info	Type of Project	Research	Duration (months)	43
	Total Budget	€ 3,457,004.45	Start Date	01/06/2019
	EU Contribution	€ 2,074,202.67	End date	31/12/2022

Abstract

In order to allow steelmakers to comply with ever stringent environmental constraints, TACOS project aims at evaluating solutions bringing significant decrease of CO2 with consequently decrease of others main pollutants (a.o. NOx, SOx, VOC's, dioxins and dust emissions) :

- High bed heights operation for improved process internal thermal efficiency;

- Waste gas recirculation (selective and non-selective);

- Use of alternative heat inputs : (i) Alternative solid fuels (such as biomass) with or without pre-processings (gasification, hydrothermal conversion, torrefaction and pyrolysis); (ii) Combustible gases for injection at strand surface in combination with Waste Gas Recirculation to take profit of the recirculation hood; (iii) High temperature fumes produced in an external combustion chamber. It is a CRM breakthrough technique which, combined with WGR (VeLoSint original lay-out) could reach theoretically up to 50% solid fuel saving.

For evaluation of the impact of these solutions on sintering process performances and emissions, tasks consists in modelling work (mathematical model, DEM), lab trials, sinter pot trials and industrial measuring campaigns and trials.

These solutions have significant impacts on Blast Furnace process, so a special focus is also placed on their impact on sinter quality (especially on its vertical segregation) and BF performances. For that purpose a a very wide set of complementary tools not use in usual industrial practise will be used and Multi-Point Vertical Probing's will be carried out.

There are 5 partners participating to the project : CRM (BE - coordinator) ,ArcelorMittal Maizières (FR), Tata Steel IJmuiden (NL), RINA-CSM (IT) and Arvedi Siderurgica Triestina (IT).

Coordinator	*Country*	*Scientific person in charge*
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ACCIAIERIA ARVEDI SPA	IT	Vincenzo DIMASTROMATTEO

847319 (2019)	SinByOSe *SINtering with high BY-products recycling rate and environmental Optimization by SElective preparation*			
Info	Type of Project	Research	Duration (months)	43
	Total Budget	€ 1928314,40	Start Date	01/06/2019
	EU Contribution	€ 1156988,64	End date	31/12/2022

Abstract

This project proposes and tests new technologies/methods to counterbalance the factors limiting their recycling at sinter plant :

- content in undesirable chemical elements (Cu, Zn, alkalis, S, etc.);

- negative impact on pollutants emissions at sinter plant (dust, SOx, dioxins, etc.);

- fine size distribution and thus mostly negative impact on productivity.

In this context, the objective of this project is to use selective granulation and pre-processing techniques to achieve the desired synergetic effects (phase formation, pseudo nuclei, reduction of dust and pollutants, etc) or to remove the detrimental components before integration in sinter preparation and to assess and understand their impacts on the sintering process.

Recently developed concept of stiff vacuum extrusion (SVE) can help the recycling of by-products in the sinter plant to prevent or reduce diffuse dust emissions by agglomerating fine materials and to lower the hydrocarbon content of the sinter feed

Stiff vacuum extrusion will be provide metallurgical properties of the BREX which meet the requirements of the sinter process with a lower level of the binder content compared with traditional briquetting technologies. Nevertheless this technique is not yet applied for the recycling of by-products at sinter plant. For this reason the new proposal aims to prove the recyclability of reverts and the use of lower grade iron ores at the sinter plant by reducing/avoiding their negative effects on the sintering process by using them.

The foreseeable benefits of this project are the following:

• increased competitiveness of European Steel Producers, by allowing a better use low quality raw materials and by-product recyclability;

• cost effective solutions for raw materials flexibility and productivity that can be easily selected through the use of the developed methodology within this project;

• improved resources efficiency by allowing a wider range of materials as input for the sinter mix

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847293 (2019)	SafeDewPoint *Acid dew point and corrosion sensors for dynamic waste heat recovery from steel mill flue gases*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1365558,00	Start Date	01/07/2019
	EU Contribution	€ 819334,80	End date	31/12/2022

Abstract

Steel mill gases such as blast furnace gas, coke oven gas and basic oxygen furnace gas are used in coke plant, sinter plant, hot blast stoves, power plant and reheating furnaces. During the operation, fuel gas combinations can be changed every 30-60 minutes and the resulting sulphuric acid dew point temperature in the flue gas may vary between 80°C and 130°C. The flue gas temperature is usually fixed 10-20 K above the calculated maximal acid dew point (ADP) temperature to prevent corrosion damage. Thus valuable energy is lost in the periods with the lower ADP temperature. There is a potential to recover it and reuse for combustion air preheating.

The main objective of the proposal is to recover waste heat from combustion of steel mill flue gases by dynamic adjustment of the flue gas temperature above the acid dew point. For this inline monitoring of ADP temperature is required. In order to prevent damage to the heat exchangers and chimneys in case of measurement failure, inline corrosion monitoring is needed. Neither ADP nor corrosion rate monitoring has been applied in steel mill flue gases before.

In this project we will develop a novel inline ADP sensor with the reaction time of < 3 min. Furthermore, corrosion probes based on the measurement of resistance of a corroding wire will be adapted to steel mill flue gases to reach reaction time < 5 min and lifetime ≥ 7 days. Dynamic waste heat recovery concepts on basis of these measurement signals will be developed and validated in operational tests.

This innovation will enable improvement of energy efficiency of hot blast stoves, power plants and reheating furnaces by dynamic recovery of up to 20% waste heat from the flue gas using existing facilities. For the European steel industry it equals to savings of 3568 GWh/y or 107 million €/y and emission reduction of 720 ktCO2/y. It will support competitiveness and sustainability of European integrated steel plants.

Coordinator	*Country*	*Scientific person in charge*
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847285 (2019)	**MinSiDeg** *Minimise sinter degradation between sinter plant and blast furnace exploiting embedded real-time analytics*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,646,869.60	Start Date	01/07/2019
	EU Contribution	€ 1,588,121.76	End date	31/12/2022

Abstract

High quality sinter produced with low costs and emissions is important for iron production. Stresses during transport generate return fines that must be processed again. Conventional sinter quality monitoring is slow and expensive.

In MinSiDeg, several innovative on-line methods for continuous quality monitoring will be established, and combined and exploited within new embedded real-time tools for machine supported quality control. The degradation during transport will be minimised by new transfer systems.

As a result, the losses due to transport will be minimised and high and stable quality sinter will be produced with low costs and energy consumption.

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847260 (2019)	**Slagreus** *Reuse of slags from integrated steelmaking*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,235,085.40	Start Date	01/06/2019
	EU Contribution	€ 741,051.24	End date	30/11/2022

Abstract

The main points of focus of the project will be the internal recycling of a Fe-enriched BOF slag fraction as a substitute for raw material as iron ore fines for the sinter plant and the external use of a Ca- and P enriched BOF fraction as high valuable cement additive and fertilizer. A new processes chain will be developed to increase the reuse.

At the BOF slag special emphasis will be laid on a new process route to concentrate the Fe-content and reduce the P-content in the substitute. The route comprises a primary liquid Fe-enrichment by slag recirculation and secondary solid and dry Fe-enrichment processes. The enrichment processes take benefit from differences of physical and chemical slag properties as density, viscosity, solidification properties, magnetic susceptibility, hardness and thermal expansion.

The secondary Fe-enrichment consists of a microwave assisted comminution of the BOF slag, selective grinding and dry magnetic separation. The secondary Enrichment step will multiply the Fe-concentration in the substitute of the primary step and further reduce the P-content. Simultaneously the quality of the Ca-rich non magnetic fraction will be improved. Due to the dry processing of the BOF slag the produced Ca-rich fractions will keep the hydraulic properties. On this basis the Ca-rich fractions will be evaluated for an external use in the cement industry as a raw meal in clinker production and as alternative reactive cement main constituent. Also the external use of the CaO-rich fraction from magnetic separation as lime fertilizer will be evaluated.

The internal and external reuse concepts of SLAGREUS will be assessed regarding the environmental and economic advantages.

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847256 (2019) HydroPick

Analysis and control of hydrogen content during steelmaking

Info				
	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,533,750.75	Start Date	01/06/2019
	EU Contribution	€ 920,250.45	End date	30/11/2022

Abstract

The objective of the research project is to enhance the control of the hydrogen content during the different steps of liquid steelmaking, to reliably achieve low target hydrogen contents in the final product under reduced energy and resource consumption.

For this purpose, detailed investigations on hydrogen pick-up and removal throughout the key processes of liquid steelmaking, i.e. secondary metallurgy and continuous casting, will be performed. They will be accompanied by dedicated measurement campaigns of the hydrogen content dissolved in liquid steel and the transfer into the as cast material based on novel in-situ measurement technologies. The results of these investigations will be used to derive correlations of hydrogen content evolution with the process conditions during the different treatment steps with focus on ladle treatment as well as casting via the tundish. On this basis dynamic process models for the relevant mechanisms and metallurgical reactions of hydrogen pick-up and removal will be set up. The models will be used in combination with optimised in situ measurements to monitor and predict the evolution of the hydrogen content dissolved in liquid steel throughout the complete process chain.

A combination of model-based advisory system, in situ measurement strategies and dynamic control of process parameters will be developed to apply optimal operational practices for the quality-dependent demands, for a reliable achievement of the target hydrogen content in the final product under minimum energy and resource consumption. The complete system will be tested and validated under industrial conditions in plant trials and established for operational practice for the production of different steel grade groups.

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800771 (2018)	SPARERIB			
	Semi-coke Particles Evolution and Raceway Instrumentation at the Blast Furnace			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,782,883.65	Start Date	01/12/2018
	EU Contribution	€ 1,669,730.19	End date	30/06/2022

Abstract

Semi-coke particles Evolution and Raceway Instrumentation at Blast Furnace. Coal behaviour in the shaft is unknown but highly important because of its influence on permeability, melting and smelting behaviour and therefore productivity.

Sensors and instrumentation techniques need to be developed and used in raceway/shaft models for understanding.

There have been numerous investigations on coal conversion in the raceway, but much less about the relationship between raceway and consequences on the shaft performance. There should be more measurements available: Shaft information can be gained from AreclorMittal's vertical probings at the EBF and industrial Hearth/raceway/dripping zone carbon/char built up from EBF and thyssenkrupp Steel core drills Raceway model development with ArcelorMittal, Tata Steel and Mefos

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800762 (2018)	**ECOSLAG** *Eco-friendly steelmaking slag solidification with energy recovery to produce a high quality slag product for a sustainable recycling*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,336,703.35	Start Date	01/06/2018
	EU Contribution	€ 1,402,022.01	End date	30/11/2021

Abstract

The project aim is to find technical solutions for heat recovery from steelmaking slags while producing a high quality slag product for external or process internal utilization. Three main topics will be investigated:

1. Development and testing of an advanced process for heat recovery and material recycling by re-charging of hot LF slag into the EAF process as lime substitute (MAU, FEhS);

2. Development and testing of heat recovery, drying and recycling of BOF slag by further developing the current technology partially developed by SFTec (SFTec, MEFOS);

3. Development and testing of an advanced air/water granulation of EAF slag directly at the furnace (online EAF slag treatment) (Tenova, ACP, CSM);

4. Development of heat utilization concepts for the recovered heat from steelworks slags and investigation / evaluation of technical solutions for:

• the recovery of heat from slag in a heat vector (water, air, steam) to be used directly in the steel process (i.e. solid material drying, scrap pre-heating) or to produce valuable energy to export (i. e. hot water for district heating) (SIDENOR, CICe, Tenova, MEFOS, SFTec);

• direct generation of electrical energy by thermoelectrical technology (CSM, Tenova, ACP);

Different solidification methods will be investigated in order to give options to the steelwork as to the method that will work for them while finding solutions for:

1) transport, storage and distribution of liquid steel slag directly after tapping;

2) alternative solidification methods to avoid/minimise the use of direct water cooling obtaining a proper cooling rate to be maintained during the solidification stage of slag and the handling of hot solidified slag;

3) to provide a suitable slag (high energy content, but transportable) for internal recycling in the steelmaking process or for a conventional system for the recovery of the heat;

4) reducing as much as possible the dust dispersion and gas emission during the slag cooling/handling;

5) producing marketable slag.

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800654 (2018)	WHAM *Water and related energy Hub Advanced Management system in steelworks*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,159,818.20	Start Date	01/09/2018
	EU Contribution	€ 1,295,890.92	End date	28/02/2022

Abstract

The overall objective of the WHAM project is to radically change the current water paradigm, by developing an innovative approach to improve the efficiency of the global water system reducing the water consumption, increasing the reusability by the adoption of innovative technologies. The project aims to set-up a widely deployable methodology based on a customizable supervision system targeted to industrial water networks which are typically found in the steelworks. Moreover innovative water treatment will be tested in several use cases. Such system will implement diagnostic capabilities aiming at highlighting water losses and water systems malfunctioning by jointly achieving an efficient steelworks water circuit management. Moreover WHAM aims at lowering the water intake minimizing the ecological foot print incrementing the recycling of water while assuring sufficient water quality for process conduction. The monitoring and optimization system connected to the innovative water treatment constitute powerful tools to improve the water and related energy utilization by achieving the following targets: • a correct management of the different water sources, including rain water, depending on the requirements and operating conditions of each process; • the minimization of the cooling water losses; • the improvement of the energy efficiency of the water circuit by adjusting the operation mode of its units; • the minimization of the freshwater consumptions, by jointly reducing the related costs in terms of energy and chemical additives and improving the overall environmental impact of the production process • the increase of water reusabilty recycling back into the process current wastewaters such as the cleaning solutions through the adoption of innovative water treatments.

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800643 (2018)	LOWCARBONFUTURE *Exploitation of projects for Low-Carbon future steel industry*			
Info	Type of Project	Accompanying Measures	Duration (months)	24
	Total Budget	€ 950,332.80	Start Date	01/04/2018
	EU Contribution	€ 950,332.80	End date	31/03/2020

Abstract

The Accompanying Measure activity "LowCarbonFuture" summarizes, evaluates and promotes research projects and knowledge dealing with CO2 mitigation in iron and steelmaking. Current pan-European research is focused on the three pathways Carbon Direct Avoidance (CDA), Process Integration (PI) and Carbon Capture, Storage and Usage (CCU).

"LowCarbonFuture" will generate a roadmap stating research needs, requirements and boundary conditions for breakthrough technologies and a new CO2 lean steel production to guide the EU steel industry towards the world's climateagreeements and the EU climate goals, e.g. by implementing the key findings in the strategic research agenda of the European Steel Technology Platform (ESTEP). Furthermore, "LowCarbonFuture" will contribute to an update of the steel roadmap for a low carbon Europe 2050 and the current Big-Scale initiative of EUROFER.

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754200 (2017)	**REMOCOAL** *Real Time Monitoring of coal composition in closed systems for fast process control*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,787,968.20	Start Date	01/01/2018
	EU Contribution	€ 1,072,780.92	End date	30/06/2021

Abstract

To optimize cost and process of the hot metal production real time information as well as fast data processing of the composition/quality of the raw and burden materials charged are necessary. With this knowledge the blast furnace (BF) can be better adjusted to optimum conditions in terms of reducing agent rate as main driver of operating costs. For competitive hot metal production high pulverised coal injection rates under minimized low coke rate conditions are aimed. Actual there is a lack of real time analyses techniques as well as data evaluation to obtain secure short time information of the actual properties of injected coal blend in the blast furnace. The real time analysis and data evaluation of the injected pulverised coal blend before injection in the BF gives the opportunity to detect unexpected or prompt deviation in coal blend composition and enables an optimized total BF fuel rate, a reduction of fuel cost of hot metal production and subsequently decreasing CO2 emission. A solution called Neutron Probe (NP) can be delivered by adapting an in situ analyzing technology based on Pulsed Fast and Thermal Neutron Activation. By applying this technology on a basis of the design of an existing downhole tool used for exploration and the modification of the real time data evaluation software an innovative approach for prompt analysis of the pulverised coal blend can be provided. The main objective of this project is to realise the mentioned adaption and to demonstrate the high benefit for industrial application by better adjusting/controlling the pulverised coal injection rate and improve the production process both from an economical and ecological point of view.

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754197 (2017)	**FINES2EAF** *Cement-free brick production technology for the use of primary and secondary raw material fines in EAF steelmaking*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,624,989.35	Start Date	01/07/2017
	EU Contribution	€ 974,993.61	End date	31/12/2020

Abstract

Recent years have seen a world-wide change in the environmental policy towards integrated pollution prevention and control, taking into account all environmental media. It is estimated that steel-making activities in Europe produce about 80 million tonnes annually of by-products and waste, equivalent to half of the European steel production, of which more than 10 million tonnes is waste for disposal. This waste of resources and land area is not sustainable and has to be decreased in the future.

The Fines2EAF project aims to increase the value of steelmaking residues by internal recycling and (re)use in the form of cement-free bricks. The benefit of this strategy is threefold: improved utilization of residues, internal recovery of metals and reduction of the amount of dumped materials. Through demonstration by operational tests the technology of cement-free bricks could become more acceptable for the steel works.

The approach followed is the development of an innovative process to produce cement-free bricks on the basis of primary and secondary raw material fines, alternative binder systems and a hydraulic stamp press. The bricks have to possess sufficient cold compression strength for low-abrasion handling and, for self-reducing bricks, sufficient reduction behaviour and metallurgical performance. To achieve these goals the fundamental understanding of the bricks, their manufacturing and their subsequent use in the EAF is necessary.

Project activities will develop methods, processes and solutions for:

• Economic (re)using of low volume primary and secondary raw material fines in EAF steelmaking;

• Closing inter-sectoral material loops within the EAF steelmaking route by production of tailor-made high quality charge materials for the EAF;

• Recovery of metals in secondary raw material fines;

• Reducing the amount of waste materials, environmental impact and saving costs of raw materials.

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754113 (2017)	SUPERCHARGEEAF *Supervision of Charge Material Properties in EAF steelmaking Utilising Advanced Statistical Methods*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,281,833.40	Start Date	01/07/2017
	EU Contribution	€ 769,100.04	End date	30/06/2020

Abstract

A model relies on the quality and consistency of its input data. Normally estimations of charge material properties (such as chemical composition, specific energy consumption and yield coefficients) form the base for model-based EAF charge mix calculation and energy control. However, the material properties may vary over time resulting in decreased prediction accuracy of steel chemistry, slag chemistry, energy consumption and steel temperature. The same properties also affect the value in use of the materials. Ultimately, variations in material properties render existing material mix optimizations and process models obsolete.

Furthermore, as there is no reliable method available for on-line analysis of charge material properties, existing process models can never be fully reliable. This necessitates use of comprehensive safety margins regarding chemical composition and temperature of the steel. Since raw materials are the most expensive part in electrical steelmaking with 70-90 % of the total production cost and energy consumption constitutes the second largest cost with 10-15 %, an efficient use of raw materials and energy is of the outmost importance in order to keep the production costs at a competitive level.

This project intends to use advanced statistical methods to correlate systematic errors in model predictions (of steel and slag chemistry, energy consumption, etc.) to use of specific charge materials and thereby identify errors in estimated material properties. Hence, statistical methods will be applied to calculate the probability that the estimated material properties of individual materials are correct. The project will lead to a supervision system for early detection of charge materials in the EAF with incorrect properties; thereby, avoiding excessive use of alloy elements, high quality scrap and energy. Naturally, this will allow for significant savings in production cost and give a better platform for future price negotiations with suppliers.

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754064 (2017)	OXYMON *Optimisation of the oxygen use in EAF steelmaking by direct process monitoring of the chemical melt reactions*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,788,479.75	Start Date	01/07/2017
	EU Contribution	€ 1,073,087.85	End date	31/12/2020

Abstract

The EAF has a high demand on electric and chemical energy for melting scrap and superheating. In the EAF chemical energy is applied in different ways:

• By oxygen injection through bottom nozzles to decarburise the melt;

• By oxygen-natural gas burners during melting phase and;

• By oxygen jets to decarburise the melt, to promote slag foaming in combination with carbon injection and for post combustion.

All these contributions are hard to separate, thus the individual influence on the overall furnace performance and the efficiency of the different oxygen sources is difficult to determine and to optimise.

The objectives of the proposed project are to

• Investigate metallurgical reactions by injection of oxygen gas in the liquid steel bath;

• Optimise the use of oxygen at the bottom nozzle, as well as oxygen jets and gas burners;

• Determine optimal carbon additions to diminish iron oxidation;

• And thus to optimise the efficiency of chemical energy input while maximising productivity and resource efficiency and minimising maintenance effort.

To investigate and to optimise the efficiency of the different chemical energy sources, dedicated measurement and modelling tools are used:

• A local fibre optical liquid steel temperature measurement will be applied to measure the hot spot temperature of oxygen blowing directly in the process. This will be used to monitor in-situ the effect of relevant metallurgical reactions as decarburisation and metal oxidation on the local melt temperature;

• A detailed multi zone reaction model on the basis of thermodynamic and kinetic calculations will be developed to estimate the energy contribution and efficiency of the individual chemical reactions;

• A dynamic process model will be enhanced to calculate from a mass and energy balance based on cyclic process data the time evolution of the mean melt temperature and the oxidation status with carbon and oxygen content based on more precise and individual input.

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754055 (2017)	**DUMICO** *Dust minimisation and control at the blast furnace*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 4,411,209.50	Start Date	01/07/2017
	EU Contribution	€ 264,6725.70	End date	31/12/2020

Abstract

The blast furnace operators continuously face new challenges to improve process efficiency and increase PCI rates while using raw materials of fluctuating and lower quality. BF dust is generated mechanically and chemically, e.g. from raw material handling, charging and disintegration during burden descent as well as during combustion and reduction. Of specific importance is the source of C, from coke or coal, as well from which region in the BF C and Fe origin, these parameters could e.g. indicate low efficiency of injected coal and unfavourable gas distribution. By applying knowledge of the relationships between dust characteristics, descibed by an innovative BF dust fingerprint approach, and blast furnace stability combined with new and more rapid dust characterisation techniques, the blast furnace process control can be improved.

More stable operation and reduction in dust will reduce energy consumption, CO2 emissions, reduce losses of C and Fe units in dust and improve flexibility in raw materials selection.

The objectives of the project are to improve blast furnace stability and reduce BF dust generation by:

• Introducing innovative off-line/in-line/on-line monitoring allowing rapid identification of dust origin and cause;

• Establishing the link between operational conditions including charging and injection on dust amount and characteristics, including fundamental mechanisms of dust formation;

• Developing and validating operational control strategies for disturbance mitigation and dust control.

Developed methods and strategies are due to the wide approach after required adaptation transferable to other BFs in Europe.

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SSAB EUROPE OY	FI	Dr Timo PAANANEN
TATA STEEL NEDERLAND TECHNOLOGY BV	NL	Mr Stefan BORN
LUOSSAVAARA-KIIRUNAVAARA AB	SE	Ms Anna DAHLSTEDT

749809 (2017)	ACTISLAG *New Activation Routes for Early Strength Development of Granulated Blast Furnace Slag*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 2,880,450.75	Start Date	01/07/2017
	EU Contribution	€ 1,721,070.45	End date	30/06/2021

Abstract

ActiSlag global objective is to define efficient activation routes based on a two-step process to produce a "second generation GGBS" (Ground Granulated Blast Furnace Slag) which will be assessed in formulations for concrete or dry-mix mortar. The target is to reach 80% GGBS addition in cement while keeping the specifications of CEM II (20% of classical GGBS). Such products will be more than welcome by construction material players having to combine improved environmental footprint, competitive costs and better quality concretes and mortars.

After implementation of project results and opening of new markets and products, steel producers will thus become more independent from the main GBS customers (cement makers). Prices will not be pressured anymore by cement makers and marketing diversification will become more flexible. Thus, ActiSlag will strengthen the competitiveness of EU steelmaking industry by reducing the market pressure and by increasing the value of this ironmaking by-product material.

This study will be supported by fundamental investigations to further understand slag multi-scale structural organization, reactivity and behavior during early strength development which remains problematic with standard GGBS. We aim to overcome this drawback by finding the best combination of upstream (slag chemical composition, structural organization) and downstream modification (chemical activation system, curing temperature, GGBS fineness) routes.

The key findings will enable to validate the concepts and define the scope of a pilot project. The gained experience also allows improving the quality of existing slag based products.

Coordinator	*Country*	*Scientific person in charge*
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Dr Judit KAKNICS
Partners		
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TECHNISCHE UNIVERSITAET CLAUSTHAL	DE	Prof Joachim DEUBENER
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE - CNRS	FR	Dr Valérie MONTOUILLOUT
UNIVERSITE PAUL SABATIER TOULOUSE III	FR	Prof Martin CYR
ECOCEM MATERIALS LIMITED	IE	Mr Garry GROGAN

Technical Group Steel 2

Downstream Steel Processing

The scope TGA2 includes:

- Chemistry and physics of solidification & precipitation related to casting processes
- Continuous casting, ingot casting and near net shape casting techniques with or without direct rolling for flat and long products
- Heat treatment technology, including reheating furnaces, and thermal treatments
- Hot and cold rolling
- Reliability of production processes and maintenance of production lines
- Surface engineering, chemical treatments, finishing and coating technologies
- Instrumentation, modelling, control and optimisation of downstream steel production processes
- Reduction of emissions, energy consumption and improvement of the environmental impact in downstream processes
- Energy, water and material flow management in downstream

898817(2020)	**BURWEAR** *Modelling and reduction of back-up roll wear in cold rolling and temper rolling mills*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 2,406,850.10	Start Date	01/10/2020
	EU Contribution	€ 1,444,110.06	End date	30/09/2024

Abstract

Performance of Back-Up Rolls (BURs) in flat rolling mills is limited by two factors, namely wear and rolling contact fatigue (work hardening). In practice, BURs often exhibit very inhomogeneous wear rates over their barrel length. Local wear rates and the resulting BUR wear profiles are usually not understood and (thus) not well predicted.

The BUR wear profile has, in turn, a large effect on the local Hertzian work roll - BUR contact stress distribution along the BUR barrel length. This crucial parameter for rolling contact fatigue is also unknown and also highly inhomogeneous. Consequently, also the onset of local rolling contact fatigue at the BUR surface is poorly predicted and may in fact differ

strongly between consecutive mill campaigns of the same BUR, so that mills struggle to define adequate (= safe and economical) practical maximum BUR campaign length limits.

BUR wear is affecting the rolling mills in 4 ways: Rolling process stability (risk of pinching), product quality (strip shape deviations), loss of mill OEE (when unscheduled BUR changes are needed) and costs associated with BUR consumption.

In this view, the project aims to:

• Develop and validate a physical model that quantitatively describes the evolution of the back-up roll wear profile during a

cold rolling or temper rolling campaign;

• Develop and validate a second model (coupled to the first model) that quantitatively describes the evolution of back-up roll

contact fatigue during a cold rolling or temper rolling campaigns

• Utilize these models to:

(a) improve strip shape control (avoid pinching and improve product quality).

(b) optimize scheduling of back-up roll changes and increase back-up roll campaign length.

(c) enhance mill output and reduce operating costs of the rolling mill.

Coordinator	*Country*	*Scientific person in charge*
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GONTERMANN-PEIPERS GMBH	DE	Mr Peter HEISTERKAMP
UNIVERSITEIT TWENTE	NL	Dr Matthijn DE ROOIJ

882678 (2020)	**RollProf** *On-line and real time meaurement of ROLL PROFile in hot and cold rolling mills*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	42
	Total Budget	€ 1,019,190.00	Start Date	01/07/2020
	EU Contribution	€ 509,595.01	End date	31/12/2023

Abstract

This pilot and demonstration project aims to develop an ON-LINE / REAL-TIME measurement system for ROLL PROFILES in HOT and COLD rolling. The system will allow in the harsh rolling mill environment to measure the profile of work rolls and pinch rolls during rolling. A very high accuracy is aimed over a roll table width up to 2m. The measured data will be used to optimise/validate roll crown evolution models integrated in flatness control. In the future also real-time control actuators for roll profile control can be envisaged improving the flatness of hot and cold rolled products.

Coordinator	*Country*	*Scientific person in charge*
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ARCELORMITTAL ATLANTIQUE ET LORRAINE SAS	FR	Mr Damien FEUILLU
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Mr Nelson SOUTO

899290 (2020)	**ReduHeatLoss** *Reduction of Heat Losses during Hot Rolling of Long Products*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,750,524.00	Start Date	01/07/2020
	EU Contribution	€ 1,650,314.40	End date	31/12/2023

Abstract

ReduHeatLoss aims to reduce heat losses during hot rolling of long products. To improve the efficiency of the hot rolling process heat losses have to be minimised. There are heat sinks/heat losses in form of temperature losses that cannot be reduced without a high financial and technical effort due to the design and process management of the existing rolling mills like heat dissipation by radiation, convection and contact with plant components such as roller conveyor rolls. Other heat sinks such as descaling, work roll cooling and cross sprays can be minimised with little effort in terms of design or process engineering. The main aspects in ReduHeatLoss deal with the process steps leading to heat losses in hot rolling due to the descaling and work roll cooling processes. These processes have a significant influence on product quality and work roll performance. To improve this situation new work roll cooling and descaling systems need to be developed and implemented. Moreover, stress sources vary because of the different and extremely complex deformation process of long product rolling.

ReduHeatLoss pursues the following aspects:

(i) Optimised descaling strategies to reduce heat losses.

(ii) Optimised cooling strategies to reduce heat losses.

(iii) Online and intelligent control system of the optimised descaling and roll systems.

Main focus is to improve heat transfer (heat transfer coefficient). The new strategies will optimise selective removal of heat, furthermore reduce of temperature drops at the rolled material and reduce of thermal stress in the work roll. These will increase product quality and work roll performance. The connected results will be integrated into the pass sequence system of the participated plants, adjusted to the need for descaling and work roll cooling. If the new systems will lead to an improvement, they will be adapted to other sections of the involved plants. Furthermore, the results can also be transferred into European Steel Industry.

Coordinator	*Country*	*Scientific person in charge*
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	FR	Mr Tuncer UEMIT
Partners		
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HAUHINCO MASCHINENFABRIK G. HAUSHERR, JOCHUMS GMBH & CO. KG	DE	Dr Dirk SCHULZE-SCHENCKING
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VYSOKE UCENI TECHNICKE V BRNE	CZ	Dr Michal POHANKA
OMRON ELECTRONICS GMBH	DE	Mr Marc WÖRNER

899391 (2020)	**AUSSENS** *Phase transformation measurement for mechanical properties control and assessment*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	42
	Total Budget	€ 1,595,431.95	Start Date	01/07/2020
	EU Contribution	€ 797,715.99	End date	31/12/2023

Abstract

Austenite fraction at specific steps of the final thermal cycle in continuous galvanizing and annealing lines is a key parameter with respect to the end-user properties of high strength steel strips with potential savings up to 230 k€ per year for lines. This proposal aims at assessing the industrial prototype of a new electromagnetic sensor based on continuous measurement, in locations of the process where existing sensors are either very expensive, not able to operate or not sufficiently precise. This will be done in real time on moving strips in continuous galvanizing and annealing lines.

Coordinator	*Country*	*Scientific person in charge*
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TATA STEEL NEDERLAND TECHNOLOGY BV	NL	Mr Frenk VAN DEN BERG
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Mr Philip MEILLAND

899455 (2020)	**PROTEUS-RS** *Long Product Quality Optimisation through Enhancement and Utilisation of Residual Stress minimising Process Strategies*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,741,214.95	Start Date	01/07/2020
	EU Contribution	€ 1,044,728.97	End date	31/12/2023

Abstract

During rolling, straightening and thermal processing of long products internal stresses arise impairing the products material properties and causing material distortion due to stress relief mechanisms. The characteristics of those effects are still associated with a high degree of uncertainty.

PROTEUS-RS aims to overcome these constraints by

- Definition of an improved process strategy and control using predictive variables.

- Development of a hybrid process model comprising improved physical process models and data-based statistical models.

- Implementation of a digital twin of the rolled long products.

- Development of soft-sensors for an improved process control.

Thus PROTEUS-RS will allow a highly reliable and well documented processing of precise long products (perfect shape, contour accuracy, straightness), reducing scrap, production downtimes and failures and customer complaints. PROTEUS-RS will enhance existing production mills to handle new innovative steel grades and to face the challenging demands of the customers regarding high precision steel grades. This will secure the technological leadership of European steel industry.

Coordinator	*Country*	*Scientific person in charge*
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Dr Volker DIEGELMANN
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INSTYTUT METALURGII ZELAZA IM STANISLAWA STASZICA	PL	Prof Roman KUZIAK
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MANNSTAEDT GMBH	DE	Andreas FALCK
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847194 (2019)	VALCRA *Valorisation and dissemination of RFCS projects results and experience in steel surface quality issues: on as-cast cracks formation*			
Info	Type of Project	Accompanying Measures	Duration (months)	18
	Total Budget	€ 477,008.60	Start Date	01/06/2019
	EU Contribution	€ 477,008.60	End date	30/11/2020

Abstract

In the framework of the European Steel research programmes (ECSC and RFCS) many projects have been carried out on the formation of cracks in continuous casting, aiming at facing this occurrence and its harmful impact on surface and internal product quality. Within these projects, deep fundamental investigations, measurement technologies, process models and online control approaches were developed. The objective of this dissemination project is to analyse, valorise and disseminate the achieved knowledge and results obtained in the previous projects in the mentioned topics. Also a road map with future industrial targets and research needs will be defined.

Coordinator	*Country*	*Scientific person in charge*
RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Arianna GOTTI
Partners		
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MATERIALS PROCESSING INSTITUTE	UK	Mr Alan TAYLOR
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SWEREA MEFOS AB	SE	Dr Pavel Ernesto RAMIREZ LOPEZ

847269 (2019)	**OPTILOCALHT** *Optimisation of Local Heat Transfer in the CC Mould for Casting Challenging and Innovative Steel Grades*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 3,815,692.30	Start Date	01/07/2019
	EU Contribution	€ 2,289,415.04	End date	30/06/2023

Abstract

Currently, mould powder selection is a compromise between the conflicting requirements for controlling the rate of heat transfer and lubrication. OPTILOCALHT offers the opportunity to 'un-couple' these functions when casting crack-sensitive micro-alloyed and peritectic grades; as well as reducing the negative impact on infiltration and lubrication due to reactions between slag and Al and Ti present in innovative steel grades.

Four main approaches are proposed:

(1) Easy to apply "intumescent coating" that increases interfacial resistance only on specific areas of the mould and is removed with the strand at the end of the sequence. This creates the possibility of mild cooling in the meniscus region whilst maintaining lubrication or permitting higher rates of heat transfer lower in the mould, to allow faster casting.

(2) "Electrical methods" that induce local changes in the crystalline structure of the slag film to produce the required local heat flux for optimal strand solidification and changes in wettability and viscosity to control flux consumption and lubrication.

(3) Advanced numerical simulations to predict the ideal heat fluxes for given mould designs and casting process parameters.

(4) Advanced High-Resolution temperature measurements based on an Industry 4.0 platform capable of online display and analysis of heat transfer data combined with caster performance records.

Small-scale laboratory trials, cold finger tests, pilot plant trials and industrial trials on bloom and billet casters will be supported by the development of new and fast techniques for the characterisation of slag film properties relevant to heat transfer. In addition, virtual and augmented reality, digital twinning and remote access will be used to provide new insights into the continuous casting process and to evaluate the performance of the coating and electrical methods in modifying local heat transfer to improve product quality.

Coordinator	*Country*	*Scientific person in charge*
MATERIALS PROCESSING INSTITUTE	UK	Dr Bridget STEWART
Partners		
SWEREA MEFOS AB	SE	Dr Pavel RAMIREZ LOPEZ
SANDVIK MATERIALS TECHNOLOGY AB	SE	Dr Karin HANSSON-ANTONSSON
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Ms Maite CORNILLE
THE UNIVERSITY OF WARWICK	UK	Dr Zushu LI
THE OPEN UNIVERSITY	UK	Prof Rongshan QIN
ABB AB	SE	Mr Hongliang YANG
SIDENOR INVESTIGACION Y DESARROLLOSA	ES	Dr Diana MIER VASALLO

847341 (2019)	**CentriClean** *Metallic coating bath cleaning by centrifugation*			
Info	Type of Project	Research	Duration (months)	43
	Total Budget	€ 1,379,954.90	Start Date	01/06/2019
	EU Contribution	€ 751,768.14	End date	31/12/2022

Abstract

Modern batch and continuous galvanizing processes still suffer from the production of large amounts of zinc ash, top dross and/or bottom dross that induce downgraded products, reduce productivity or demands frequent line stops for dross removal, as many sources of safety issues for operators to clean the bath.

The project will focus on:

• New concepts to reduce dross production and corrosion of immersed equipment,

• Cleaning of industrial melts by centrifuge means to separate the small abrasive solid particles from the corrosive base liquid metal (various Al content),

• Exploration of new upcycling ways for such depreciated wastes.

Coordinator	*Country*	*Scientific person in charge*
CENTRE DE RECHERCHES METALLURGIQUES ASBL	BE	Mr Olivier BRÉGAND

Partners

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NV BEKAERT SA	BE	Dr Lucia SUAREZ
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INTERNATIONAL ZINC ASSOCIATION - EUROPE	BE	Dr Frank GOODWIN

847334 (2019)	**RealTimeCastSupport** *Embedded real-time analysis of continuous casting for machine-supported quality optimisation*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,100,785.65	Start Date	01/07/2019
	EU Contribution	€ 1,260,471.39	End date	31/12/2022

Abstract

The thermal and fluid-mechanical conditions in continuous casting moulds are not precisely known although highly relevant for the product quality. Manual process control is very difficult due to the big number of influencing factors which are often happening time-shifted. Therefore the aims of the proposed project are the optimised control and digitalisation of continuous casting machines aiming at an optimised product quality. Large data streams from different sources and of different types will be taken into account online in a Big Data environment. Assistance for the caster operators will be given by real-time support system. It will provide suggestions for adjusted casting conditions in real-time. Additionally predictions of defect probabilities will be estimated based on the current caster status and an intensified product inspection will be suggested if necessary.

These project aims will be supplemented by new measurement technologies for thermal and caster powder monitoring. Defect promoting scenarios will be identified by application of statistical data analytics and correlations with quality data of the heavy plates and cold-rolled strips. These scenarios will be represented with a digital twin of the continuous casting machine aiming at identification of thermal and fluid-mechanical reasons for the observed defects. The digital twin allows also the development of countermeasures aiming at the avoidance of decreasing rolled product quality.

The proposed work will lead to rules and guidelines which will be checked in real-time assessing the current status of the casting machine. The findings from the statistical data analytics as well as the developed countermeasures will be the basis for the rules and guidelines aiming at an optimised process control. Both will be integrated in the real-time support system and applied online. The effectivity of this approach will finally be verified in industrial trials.

Coordinator	*Country*	*Scientific person in charge*
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Dr Carsten TSCHEUSCHNER

Partners		
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MATERIALS PROCESSING INSTITUTE	UK	Mr Stuart HIGSON
MINKON SP ZOO	PL	Mr Mark POTTER

847318 (2019)	**CleanEx** *On-line characterisation of the cleanliness of coils to be galvanised for exposed automotive parts*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	42
	Total Budget	€ 1,451,868.30	Start Date	01/06/2019
	EU Contribution	€ 725,934.16	End date	30/11/2022

Abstract

Today, automotive steel customers are very demanding concerning the coating quality, especially for exposed parts for which no defect is allowed.

To satisfy this requirement at the exit of the galvanising line, the perfect cleanliness of the substrate surface after the cleaning section in terms of carbon pollution and iron fines must be ensured. Indeed, if carbon (as component of the mill oil) is still present at the surface when entering the furnace, furnace pollution will occur in the long term by production of soot that will not only stay on the furnace walls but will eventually lead to dirt falling on the rolls and/or on the strip.

On the other side, the iron fines can also lead to roll pick-up defects inside the furnace, to an increase of dross in the bath by combination with zinc and aluminium and also to a drift of the bath composition.

These phenomena will eventually result in aspect defects on the final product.

A direct on-line measurement is so mandatory to fully evaluate and control the surface cleanliness all along the coil and is more and more required by customers as an assurance of final product quality.

Using this cleanliness measurement, the cleaning section can be optimized by adjusting relevant parameters, such as the brushes pressure, the solution composition, the current applied if electrolytic cleaning is used.

As, today, no on-line method able to separately measure the mentioned pollutants exists on the market, this project aims at developing an on-line system using the LIBS principle. This will be realized by using an innovative approach that will allow reaching the measurement sensitivity required after the cleaning section.

This system will so constitute the basis for future tuning procedures of this section.

Coordinator	*Country*	*Scientific person in charge*
CENTRE DE RECHERCHES METALLURGIQUES ASBL	BE	Mrs Genevieve MOREAS
Partners		
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SEGAL	BE	Mr Michel MASSON
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Dr Cyrielle ROQUELET
ARCELORMITTAL ATLANTIQUE ET LORRAINE SAS	FR	Muriel KLEIN

800769 (2018)	**HIGHSPEEDGALVANIZING** *Towards galvanizing at higher speed through roll rotation improvements, strip stabilizing at wiping level and adapted dross skimming*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 3,119,235.75	Start Date	01/06/2018
	EU Contribution	€ 1,871,541.45	End date	30/11/2021

Abstract

Increasing the galvanizing line speed is challenging for reducing the production cost. A lot of galvanizing lines are presently reaching speed about 160 m/min depending on the strip format. However, steel customers are still more and more demanding for high coating quality without any surface defects.

Several issues, regarding the bath galvanizing area, are limiting the increase of line speed. In fact, running above 200 m/min is not of current practice in industrial lines. Among those topics, bath immersed hardware, intensive skimming and wiping are of major importance.

The objectives to be reached in this proposal are in short to face issues impeding galvanizing high line speed by:

• The development of new bearings giving a smooth roll rotation at high line speed with a low maintenance profile, through ball-bearings improvement and new “tight” bearing conception.

• The improvement of the dedrossing operation coherent with high production of surface scums.

• The development at a pilot stage of new co-wiping equipment.

Such kinds of development are in line with the constant increase of productivity of most HDGL. Of course, other parts of such complex production lines are susceptible of impeding line speed increase, but a lot of research work is also dedicated to these (increase of furnace capacity, cooling capacity increase, etc…).

Solutions brought in this research project will also help opening solutions for other types of metallic baths. In parallel with an increase of the line speed, effects are also awaited on the coating quality in terms of repeatability and stability. Better conditions for labor work are also expected.

Coordinator	*Country*	*Scientific person in charge*
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V2I	BE	Dr Daniel SIMON
UNIVERSITE DE LIEGE	BE	Prof Jean-Claude GOLINVAL
HEEMSKERK INNOVATIVE TECHNOLOGY BV	NL	Dr Cock HEEMSKERK

800644 (2018)	PMAPIA *Precipitation of Micro Alloy Particles in B and Mn alloyed steel grades and their Interaction between elements, segregation, and defects during continuous casting*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,061,162.00	Start Date	01/06/2018
	EU Contribution	€ 1,236,697.20	End date	30/11/2021

Abstract

Today, micro-alloyed steel grades represent 80% of the total production by European engineering steel mills. In parallel, European producers are working on next generation AHSS concepts with high Mn contents. Both classes of steels present many industrial problems related to solidification and cooling in the continuous casting (CC) process.

The overall objective of the PMAPIA project is to reduce yield loss and requirements for surface repair due to cracking defects in CC semis by optimization of micro alloying, steel composition, and casting parameters.

In engineering steels, B and S are added to micro-alloyed steels to increase hardenability and machinability, respectively. The earlier PMAP project (RFSR-CT-2012-00008) showed that B and S are responsible for micro-segregation, increasing the risk of cracking. S reduces hot ductility whereas B increases the sensitivity to cracking during tertiary cooling. Preventing B precipitation as BN markedly improves hot ductility. PMAP showed that Mn additions counteract the negative effect of S, however high Mn content degrades hot ductility. This is a problem in higher Mn steels. It was shown that MnS secondary precipitation impairs hot ductility. These findings opened new lines of investigation for making a step improvement in the cracking problems in these steels.

PMAPIA aims to alleviate B micro-segregation induced cracking by defining the interaction between B, S, Mn, and other elements. B and S compete at austenite grain boundaries, and their interaction needs to be quantified, as B is able to counteract grain boundary decohesion , meaning B can potentially have both negative and positive effects on cracking resistance. The project will perform laboratory and pilot scale investigation followed by in-field validation of the mechanisms of interaction between elements, their segregation, and cracking. The results of this validation will be new guidelines for safe industrial casting practices for these steels.

Coordinator	*Country*	*Scientific person in charge*
SWEREA KIMAB AB	SE	Dr Jacek KOMENDA
Partners		
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ASOCIACION CENTRO TECNOLOGICO CEIT-IK4	ES	Dr Jon ARRUABARRENA

799295 (2018)	CONSOLCAST *Comprehensive Modelling, Monitoring and Control of Solidification for Optimisation of Continuous Casting Process*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,096,193.70	Start Date	01/07/2018
	EU Contribution	€ 1,257,716.22	End date	31/12/2021

Abstract

In the continuous casting process there are several performance indicators which are of utmost importance, namely, safety, costs, productivity, yield, product quality and delivery on time. There is one event which can impact on all these performance indicators, that is, the strand breakout, which is defined as the rupture of the solidifying shell, resulting in the termination of casting on the affected strand and in some instances of the casting machine.

For all caster operators, the challenge is to cast both established and new steel grades at ever increasing casting speeds, whilst maximising prime cast product and ensuring the security of the casting machine, that is, no strand breakouts. To this end it is important to understand, monitor and control solidification from the casting mould to the crater end, to ensure the production of high quality cast product, e.g. in terms of minimisation of surface defects.

The reasons for caster breakout are many, thus making it more challenging to determine in all instances the root cause and thus to put measures in place to prevent a re-occurrence. The aim is to minimise significantly the likelihood of a breakout, as well as, surface defects, by determining the optimum casting conditions for the particular steel grade, to have appropriate on-line monitoring of strand solidification and real- time alarms to alert the caster operators to non-ideal casting conditions and thus make proactive decisions regarding the improvement of the casting conditions.

In this proposed collaborative project involving European Research Institutes and Steel Manufacturers the project objectives are to demonstrate that, by a combination of innovative measurement techniques monitoring the temperature distribution along the mould faces and the crater end position, with comprehensive model based monitoring and control of solidification, the secure production of prime continuously cast semi can be maximised and therefore the caster breakout avoided.

Coordinator	*Country*	*Scientific person in charge*
MATERIALS PROCESSING INSTITUTE	UK	Mr David STAMP
Partners		
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ESF ELBE-STAHLWERKE FERALPI GMBH	DE	Dr Dariusz SOSIN

754186 (2017)	NNEWFLUX *Non-Newtonian mould fluxes – a smart viscosity response to enhancing production flexibility of steel grades prone to slag entrapment*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,506,987.50	Start Date	01/07/2017
	EU Contribution	€ 904,192.50	End date	31/12/2020

Abstract

European steelmakers aiming to produce high quality steel grades for demanding applications, are impacted by quality issues linked to the mould powders used in continuous casting. A novel concept in mould flux behaviour offers a potential breakthrough in increasing the quality, cleanness, productivity, and competiveness of continuously cast steels.

When designing conventional mould fluxes there is often a conflict between the choice to use a high viscosity flux to minimise slag entrapment in the meniscus region and a low viscosity flux to enhance lubrication in the mould-strand gap. Recent studies from outside Europe indicate that the use of mould fluxes exhibiting non-Newtonian properties in response to shear stresses, i.e. shear-thinning, offer a possibility for achieving the different viscosities required at different parts of the mould.

A collaborative project involving European research institutes, steel manufacturers and a mould powder supplier is proposed to design suitable flux compositions and investigate the benefits of non-Newtonian mould fluxes for the continuous casting of advanced steel grades of keen interest to European steelmakers. Numerical and physical modelling, together with laboratory characterisation of mould fluxes, will be key to designing the required properties and compositions of the new fluxes. The mould powder supplier will refine the chemistries based on available raw materials and any health, safety or environmental concerns. The influence of shear-thinning on slag infiltration into the mould-strand gap will be investigated and optimal oscillation parameters predicted. Casting trials will be carried out using highly instrumented moulds to continuously monitor key parameters including heat transfer and mould friction. Once pilot tests validate the new flux concept, plant trials will be carried out by industrial partners on a wide range of production formats (e.g. billets and slabs) and operational windows optimised for product quality.

Coordinator	*Country*	*Scientific person in charge*
MATERIALS PROCESSING INSTITUTE	UK	Dr Bridget STEWART
Partners		
IMERYS METALCASTING GERMANY GMBH	DE	Mr Klaus SCHULZ
SIDENOR INVESTIGACION Y DESARROLLO SA	ES	Mr Victor SANTISTEBAN
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Ms Maite CORNILLE
SWEREA MEFOS AB	SE	Dr Pavel ERNESTO RAMIREZ LOPEZ

754130 (2017)	**SUPPORT-CAST** *Supporting Control by Inspection of Surface Quality and Segregation on Cast Products through integration of Novel Online Monitoring and Advanced Modelling into an Accessible Cloud Access Platform*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 2,269,415.40	Start Date	01/07/2017
	EU Contribution	€ 1,361,649.24	End date	30/06/2021

Abstract

The project aims to develop online-monitoring systems and numerical models able to identify defects as well as support decision making to formulate guidelines that improve the quality of cast products. Sensors include strand-temperature monitoring, high-resolution visualization and topography-scanning integrated into a cloud-access-platform. These are combined with advanced numerical models to develop a regression database for defect prevention to assist operators and enhance process control. Moreover, the project identifies ideal locations for the sensors developed as well as assessing improvements in yield for stainless, carbon and micro-alloyed steels by reducing scarfing and/or grinding; thus, enhancing productivity.

Coordinator	*Country*	*Scientific person in charge*
SWEREA MEFOS AB	SE	Dr Pavel Ernesto RAMIREZ LOPEZ
Partners		
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Mr Bernd FELDMEYER
SIDENOR INVESTIGACION Y DESARROLLO SA	ES	Mrs Izaskun ALONSO
SAPOTECH OY	FI	Mr Juha ROININEN
ACCIAIERIE DI CALVISANO SPA	IT	Dr Piero FRITTELLA
OUTOKUMPU STAINLESS AB	SE	Mr Marko PETÄJÄJÄRVI

847237 (2019)	**BURNER 4.0** *Development of a new burner concept: Industry 4.0 technologies applied to the best available combustion system for the Steel Industry.*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,991,506.15	Start Date	01/06/2019
	EU Contribution	€ 1,194,903.69	End date	30/11/2022

Abstract

Combustion systems and burners for the Steel Industry have been improved in the recent years focusing on energy saving, pollutant emissions reduction and process flexibility. Burner 4.0 Project is aimed to extend the present technological limits of the combustion systems concerning different areas (design, manufacturing, control & process optimization, operating life & maintenance) to new ones through a challenging combined application of the Industry 4.0 technologies. Additive manufacturing, Internet of Things, Smart Sensors, Big Data Analytics for process optimization and predictive maintenance will be introduced to the present burners leading to a break-through burner concept for the Steel Industry.

Coordinator	*Country*	*Scientific person in charge*
TENOVA SPA	IT	Mr Massimiliano FANTUZZI
Partners		
ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS	EL	Dr Nikolaos NIKOLOPOULOS
CONSIGLIO NAZIONALE DELLE RICERCHE	IT	Dr Mariarosaria CEGLIE DE JOANNON
ARCELORMITTAL ESPANA SA	ES	Dr Victor CUERVO
DALMINE SPA	IT	Mr Maurizio RONDI
POLITECNICO DI MILANO	IT	Prof Nicola PAROLINI
RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Guido JOCHLER
SC SILCOTUB SA	RO	Mr Giuseppe BROLIS

800748 (2018)	**MASTERINGROLLSII** *Mastering work roll degradation II*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,631,738.35	Start Date	01/07/2018
	EU Contribution	€ 979,043.01	End date	31/12/2021

Abstract

This proposal aims to integrate an enhanced mastering of work roll degradation in hot rolling by applying new measurement technologies and innovative actuators developed in previous RFCS and internal research projects.

Coordinator	*Country*	*Scientific person in charge*
CENTRE DE RECHERCHES METALLURGIQUES ASBL	BE	Mr Jurgen MALBRANCKE

Partners		
SWEREA MEFOS AB	SE	Mrs Annika NILSSON
LISMAR ENGINEERING BV	NL	Mr Sander MUL
TATA STEEL IJMUIDEN BV	NL	Mr Danny BEENTJES
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Mr Thierno FALL
AKERS AB	SE	Mr Mats SÔDER

800746 (2018)	FASTLOROLL *Fast simulation tool for long product rolling*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 1,337,800.60	Start Date	01/06/2018
	EU Contribution	€ 802,680.6	End date	31/05/2022

Abstract

The finite element methods for the simulation of the hot rolling processes of long products have been subject of research over the last three decades: further developments are nowadays marginal and the technology has come to a mature condition: the reliability of the results is proven. The FE models of the hot rolling process have initially been applied for research purposes which permitted to gain a deep understanding of the rolling process: it is now time for a technology-oriented use of such models, which is based on a massive application of the simulation for an almost complete replacement of plant setup operation for the achievement of the target mechanical properties based on plant trials, which are expensive, time consuming and source of CO2 emissions. Moreover, the capability of predicting the effect of inclusions and pores on the final integrity of rolled products is a significant advantage, especially for those defects that cannot be avoided as consequence of the upstream process.

An optimized rolling setup can contribute to reduce scrap or product downgrade so as to reduce the cost per ton of produced steel by time and energy savings estimated in around 0.1%. Moreover, it would also allow reducing CO2 emissions related to the plant trials – on average, 1.8 tonnes of CO2 are emitted for every tonne of steel produced in Europe. According to the Metal Bulletin Research, in 2013 the iron and steel industry accounted for approximately 5% of total EU CO2 emissions. Massive simulations call for two main requirements of the simulation software: easy use and fast response, reliable results. Aim of FastLoRoll is the development of a fast simulation software for the analysis of multistage hot rolling processes of long products, that allows to calculate: material flow and obtained shape, temperature development, austenite deformation and decomposition, mechanical properties, inclusion and pore evolution under temperature and strain sequence.

Coordinator	*Country*	*Scientific person in charge*
RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Luigi LANGELLOTTO
Partners		
INSTYTUT METALURGII ZELAZA IM STANISLAWA STASZICA	PL	Prof Roman KUZIAK
O.R.I. MARTIN - ACCIAIERIA E FERRIERA DI BRESCIA SPA*	IT	Mr Maurizio ZANFORLIN
TECHNISCHE UNIVERSITAET BERGAKADEMIE FREIBERG	DE	Mr Stefan MEILER
CMC POLAND SP ZOO	PL	Mr Zbigniew KUTYLA

800730 (2018)	**FLATBEND** *DP1000 steel press bending holistic process chain improvement by novel control techniques and through thickness residual stress tailoring*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,775,183.80	Start Date	01/04/2018
	EU Contribution	€ 1,066,310.28	End date	31/03/2021

Abstract

The roll levelling process is responsible for providing suitable strips without shape defects and residual stresses coming from rolling processes. Normally, roll levellers ensure a flatness quality between 5-10 I-Units. However, for those materials to be cut, bent or welded in downstream processes, customers request greater flatness qualities to control the final springback, especially when using AHSS.

It is well known that material with a proper flatness tolerance can get a distortion during the subsequent processes. This distortion is caused by the inhomogeneous distribution of the stresses in the material and thus, an optimum material has to present a distributed and regular stress profile. However, the in-situ residual stress measurement of the processed material is industrially not viable with the existing techniques. Thus, the effect the residual stress variability has in the subsequent forming processes is difficult to study and still unknown.

FLATBEND industrial partners cover the whole steel process chain, starting with the steel producer and finishing with the automotive components stamper, a TIER1. Their large experience has allowed them to identify the current unsolved challenges for the processing of AHSS, which will be solved in the different Work Packages of this project.

The primary aim of the FLATBEND project is to optimize the existing DP980 processing lines for the production of defect free precuts by developing disruptive roll levelling techniques and to study the influence the precuts production process has in the press-bending process of automotive profiles. Additionally, and after understanding the relation between the incoming material condition and final springback of the components, the project will try to tailor the precuts properties by using an extra small dimension straightener before the final forming presses to create a robust and stable forming process that will reduce the manufacturing costs and the scrap amount.

Coordinator	*Country*	*Scientific person in charge*
FAGOR ARRASATE S COOP	ES	Mr Daniel GARCIA
Partners		
DATA M SHEET METAL SOLUTIONS GMBH	DE	Mr Albert SEDLMAIER
EKIDE SL	ES	Ms Ane MURUA
MONDRAGON GOI ESKOLA POLITEKNIKOA JOSE MARIA ARIZMENDIARRIETA S COOP	ES	Dr Lander GALDÓS
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Dr Olivier MADELAINE - DUPUICH
FAURECIA SIÈGES D'AUTOMOBILE	FR	Mr Vincent RETAILLAUD

800679 (2018)	RADIFLAT *Radar-based flatness measurement and control in strip rolling and processing lines*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,738,989.20	Start Date	01/06/2018
	EU Contribution	€ 1,043,393.52	End date	30/11/2021

Abstract

The worldwide first radar-based strip flatness measurement system, including strip edge detection and width measurement is developed for strip processing lines (rolling, levelling, quenching, ...). The basic technology consists of a multi-radar measurement system that is created to operate with high frequency/resolution (240–300GHz) and precisely work under the extreme conditions of strip processing in terms of dust, vapour, high temperatures, etc.

Sophisticated signal processing and process modelling methods will be developed to integrate the measurement technology in the process control and automation. The measurement system will also be made compact even for small space in existing lines, and tested in pilot and industrial mills.

Coordinator	*Country*	*Scientific person in charge*
ASINCO GMBH	DE	Dr Stefan BUSCH
Partners		
ARCELORMITTAL EISENHÜTTENTSTADT GMBH	DE	Mr Hagen KOTHE
COMTES FHT AS	CZ	Dr Zbyšek NOVÝ
FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	DE	Mr Dirk NÛßLER
ANTERAL SL	ES	Mr Gonzalo CRESPO LÓPEZ

800672 (2018)	**FLEXGAP** *Industrial demonstration of novel adaptive flat bearing with adjustable thickness for flexible gap control in rolling mills*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	42
	Total Budget	€ 704,699.75	Start Date	01/06/2018
	EU Contribution	€ 352,349.86	End date	30/11/2021

Abstract

Increasing demands for better product quality, thinner strips and greater flexibility of the production lines confront rolling mills with new challenges. The e-mobility sector in particular requires thinner sheets with even tighter thickness tolerances to increase efficiency of electric motors. Therefore, it is necessary to reduce vibration level at the rolling stands. For this purpose, the adaptive flat bearing for rolling mills was developed, which enables passive and active vibration damping. This pilot and demonstration project will be the first industrial test of the adaptive flat bearing. Installation will be performed on a cold rolling mill of thyssenkrupp Electrical Steel.

Coordinator	*Country*	*Scientific person in charge*
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Mr Moritz LOOS
Partners		
THYSSENKRUPP ELECTRICAL STEEL GMBH	DE	Mr Dirk STEVENS
CORTS ENGINEERING GMBH & CO KG	DE	Mr Jochen CORTS
COMTES FHT AS	CZ	Dr Antonín PRANTL

754071 (2017)	**INFIRE** *Strategy to increase the hot strip rolling performance in terms of surface quality, final properties and reproducibility*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,936,879.50	Start Date	01/07/2017
	EU Contribution	€ 1762127,70	End date	31/12/2020

Abstract

InFire will increase the hot strip rolling performance in terms of final properties, surface quality and reproducibility.

High surface quality of hot rolled steel strip and reproducible rolling results are a major challenge today especially for high strength steel grades (AHSS, HSLA) prone to scale related failures and downgrades. Primary scale residues, secondary and tertiary scale formed during the rolling process lead to severe surface impairments and product downgrades while influences and interrelations of the process conditions on final product quality are poorly known. This situation is not acceptable for the new innovative steel grades whose demand is constantly increasing as the hot rolling conditions change while the limits in rolling are not fully known.

To improve the understanding of the limits in the process in order to achieve reproducible final properties with main focus on the minimisation of scale related effects on the final surface texture and strip mechanical properties the project Infire was setup by four European steel producer and three research institutes.

Conducting various investigations on scale evolution will lead to

• Description, determination and evaluation of the scale formation and oxide types formed after descaling and during rolling;

• Description of surface phenomena during cooling;

• Evaluation and determination of the interactions in the rolling process including the scale formation mechanisms;

• Understanding and conditioning of scale formation during rolling and cooling, its physical properties, evolution along the hot rolling process and the interdependencies with process liquids.

The concentrated approach will lead to an improved control of existing and new actuators, a model for predicting scale behaviour and guidelines for mastering surface defects in order to deliver high yield final products. The increased knowledge will enable existing plants to handle new kind of steel grades in a more efficient and reproducible way.

Coordinator	*Country*	*Scientific person in charge*
SWEREA MEFOS AB	SE	Mr Patrik SIDESTAM
Partners		
CENTRE DE RECHERCHES METALLURGIQUES ASBL	BE	Mrs Diana ESPINOSA
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Dr Miriam SARTOR
THYSSENKRUPP STEEL EUROPE AG	DE	Mr Christian MÜLLER
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TATA STEEL NEDERLAND TECHNOLOGY BV	NL	Dr Wanda MELFO
SSAB EMEA AB	SE	Mrs Marit PERSON

Technical Group Steel 3

Conception of Steel Products

The scope TGA3 includes:

- Phase transformation, precipitation, re-crystallisation, microstructure & texture and ageing
- Predictive simulation models on microstructures & mechanical properties
- Development of steel with improved properties at low and high temperatures such as strength and toughness, corrosion, fatigue, wear, creep and resistance against fracture
- Steel products with improved physical properties including electromagnetic behaviour
- Innovative steel grades for demanding applications
- Coating development and coated steel products with appropriate surface characteristics (corrosion protection, damage control, other aspects)
- Standardisation of testing and evaluation methods

888153	**VForm-xSteels** *Toward virtual forming and design: Thermomechanical characterization of advanced high strength steels through full-field measurements and a single designed test*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 2,521,389.20	Start Date	01/07/2020
	EU Contribution	€ 1,496,357.52	End date	30/06/2024

Abstract

Nowadays, the use of numerical simulation in general and particularly finite element analysis (FEA) has become a mandatory step of material processing optimization. Reliable virtual forming would lead to stiffer, stronger, safer and lighter steel parts through using advanced models. Simulation-software uses complex material constitutive models and its success reproducing the real thermomechanical behaviour is inherently dependent on the quality of the model and related material parameters. However, todays methods to characterize the materials through constitutive models, including damage, and their parameters are expensive and not robust.

The main goal of the project VForm-XSteels is to develop an efficient and accurate methodology for material characterization and determining the material parameters of thermomechanical models, from a dedicated single test that involve non-homogeneous temperature and strain fields. Indeed, this non-homogeneity leads to richer information than more traditional approaches with quasi-homogeneous tests, thus leading to a decrease of the number of experiments. A database and online library with calibrated material constitutive models, particularly for AHSS, is also developed.

The benefits of the proposed methodology and consequent implemented numerical tool developed within this project are (i) increasing the precision of numerical FEA simulations providing accurate input data, filling then a gap of the FEA market and answering to the request of the FEA users. Therefore, the (ii) reduction of engineering metal part development lead-time and the provision of robust solutions with highly improved quality is also a benefit. (iii) Developing an automatic, accurate and trustworthy methodology for model material characterization; (iv) reducing the number of experimental tests required to characterize metal forming materials; and (v) cost and time reduction in the overall development process are also benefits of this proposal.

Coordinator	*Country*	*Scientific person in charge*
UNIVERSIDADE DE AVEIRO	PT	Prof António ANDRADE-CAMPOS
Partners		
UNIVERSITE DE BRETAGNE SUD	FR	Prof Sandrine THUILLIER
KATHOLIEKE UNIVERSITEIT LEUVEN	BE	Dr Sam COPPIETERS
UNIVERSITA POLITECNICA DELLE MARCHE	IT	Prof Marco ROSSI
MATCHID NV	BE	Dr Pascal LAVA
ONDERZOEKSCENTRUM VOOR AANWENDING VAN STAAL NV	BE	Dr Steven COOREMAN
DAF TRUCKS NV	NL	Dr Mark van DROGEN

899268	**MiPRE** *Advanced metallurgical and micromechanical modelling to deploy the microstructural tailoring potential of press hardening*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,996,061.25	Start Date	01/07/2020
	EU Contribution	€ 1,197,636.75	End date	31/12/2023

Abstract

The use of new press hardening technologies in combination with high strength metallurgical concepts is known to be the best solution to produce lightweight components. However, an integrated intelligent manufacturing approach in the context of Industry 4.0 requires the digital transformation of the process allowing that every component and quality check is digitally documented. For that purpose, a complex and integrated material model that has to cover mechanical, thermal and metallurgical effects should be developed. MiPRE aims at improving the accuracy of metallurgical and mechanical modelling to predict material properties along measurable phase paths and progress in press hardening monitoring

Coordinator	*Country*	*Scientific person in charge*
AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS	ES	Dr Calros CAPDEVILA MONTES
Partners		
FUNDACIO EURECAT	ES	Dr Daniel CASELLAS PADRÓ
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	FR	Prof Sebastien ALLAIN
LULEA TEKNISKA UNIVERSITET	SE	Dr Paul ÅLERSTRÖM
AUTOTECH ENGINEERING SL	ES	Mr Borja GONZÁLEZ
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Mr Sebastien COBO

899332	**DELIGHTED** *Design of Lightweight Steels for Industrial Applications*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,174,767.95	Start Date	01/07/2020
	EU Contribution	€ 1,304,860.77	End date	31/12/2023

Abstract

The main goal of the DELIGHTED project is to gain fundamental understanding of the principles of microstructural design for engineering of perspective austenitic Fe–Al–Mn–C lightweight steels to reach the combination of mechanical and performance properties suitable for industrial applications. The optimum thermo-mechanical processing route(s) will be developed for the selected grades. Evolution of microstructure during hot rolling and further annealing treatments will be thoroughly investigated. The main emphasis will be laid on the understanding kinetics of formation and growth of kappa-carbides, which play the key role in mechanical response and technological performance of these materials. Analytical models to predict their mechanical properties as a function of microstructure will be developed. The effect of microstructural features of the lightweight steels on technological properties (such as fracture toughness, fatigue resistance, weldability, etc.) will be analysed. A prototype of the mini-tractor cabin will be designed and produced using the developed lightweight steel for the critical parts, which have to undergo crash testing due to safety requirements. The crash test simulating the overturning of the mini-tractor will be performed. The deformation and the toughness performances of the critical parts will be estimated. The outcomes of the experiment will be compared with the results obtained earlier from testing similar prototypes made of other commercial AHSS.

Coordinator	*Country*	*Scientific person in charge*
FUNDACION IMDEA MATERIALES	ES	Dr Ilchat SABIROV
Partners		
MAX PLANCK INSTITUT FUR EISENFORSCHUNG GMBH	DE	Dr Dirk PONGE
ONDERZOEKSCENTRUM VOOR AANWENDING VAN STAAL NV	BE	Dr Xavier VEYS
UNIVERSITEIT GENT	BE	Prof Roumen PETROV
POLITECNICO DI MILANO	IT	Prof Carlo MAPELLI

899335	**HYDRO-REAL** *Hydrogen Interaction with Retained Austenite Under Static and Cyclic Loading Conditions*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,889,483.85	Start Date	01/07/2020
	EU Contribution	€ 1,034,840.31	End date	31/12/2023

Abstract

This proposal addresses the sensitivity of ultra-high strength cold rolled steels to hydrogen embrittlement, which remains a hurdle for their large-scale introduction and resulting safer, environmentally-friendlier transport applications. It is focussed on the interplay of hydrogen with retained austenite under cyclic loading conditions. The project combines state-of-the-art characterization techniques with test setups that are as close as possible to reality. The underlying mechanisms will additionally be investigated, combining ab initio methods for the hydrogen uptake and release by the austenite with continuum simulations for hydrogen distribution in the microstructure.

Coordinator	*Country*	*Scientific person in charge*
MAX PLANCK INSTITUT FUR EISENFORSCHUNG GMBH	DE	Dr Tilmann HICKEL
Partners		
THYSSENKRUPP STEEL EUROPE AG	DE	Dr Richard THIESSEN
VOESTALPINE STAHL GMBH	AT	Mr Klemens MRACZEK
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Dr Thomas DIEUDONNE
AALTO KORKEAKOULUSAATIO SR	FI	Prof Iikka VIRKKUNEN
MATERIALS CENTER LEOBEN FORSCHUNG GMBH	AT	Dr Werner ECKER
HILTI AKTIENGESELLSCHAFT	LI	Dr Michael BISCHOF

899406	**Crystal** *Control of Risk for hYdrogen embrittlement in Steels for Automotive appLications*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,353,637.25	Start Date	01/07/2020
	EU Contribution	€ 812,182.35	End date	30/06/2023

Abstract

The main objective of CRYSTAL project is to reduce the hydrogen embrittlement risk in high strength steel parts for the automotive industry. The hydrogen content in representative AHSS, cold rolled and press hardening steels, will be examined along the global value chain from the various production stages up to vehicle component life. In this sense, a novel solid-state gas sensor will be set up to quantitatively measure in-situ the hydrogen absorbed during production of steel parts. Therefore, a non-destructive methodology to evaluate HE during production and life span of the components will be defined and tested during the project. The use of a hydrogen sensor probe directly after different manufacturing processes will give an extra tool to assure part quality and will easy its implementation in an Industry 4.0 approach.

On the other hand, a range of laboratory, real plant and simulated life tests will be carried out to find an optimal evaluation test method for hydrogen embrittlement susceptibility of steels. Interestingly, a novel test based on fracture mechanics will be set-up to quickly and reliably estimate the dependence of the material cracking resistance on hydrogen content. The effort in the understanding of hydrogen-uptake mechanisms, hydrogen threshold and hydrogen embrittlement index will help to elaborate future norms of production and testing, to produce safer vehicle components and to prepare for predictive behaviour.

At the end of CRYSTAL, a set of experimental tools and novel testing methodologies will be able to predict hydrogen embrittlement in production stages and assure steel/part quality. Their implementation and validation in CRYSTAL will definitively boost the applicability of advanced high strength steels in safety related automotive parts.

Coordinator	*Country*	*Scientific person in charge*
FUNDACIO EURECAT	ES	Dr Silvia MOLAS
Partners		
CENTRO RICERCHE FIAT SCPA	IT	Dr Michele Maria TEDESCO
CENTRE DE RECHERCHES METALLURGIQUES ASBL	BE	Dr Mélodie MANDY
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Mr Thierry STUREL
VOESTALPINE STAHL GMBH	AT	Dr Andreas MUHR
LETOMEC SRL	IT	Mrs Linda BACCHI

899482	**Dynaustab** *Austenite Stability under Dynamic loading*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,355,030.15	Start Date	01/07/2020
	EU Contribution	€ 1,413,018.09	End date	31/12/2023

Abstract

The impact of retained austenite and its stability on the mechanical properties of new generation steels has been widely investigated in recent decades. However, specific knowledge is missing on the kinetics of austenite transformation under dynamic and especially triaxial loading conditions. This project aims at discovering the mechanisms both from a viewpoint of

the microstructure as well as the strain conditions that govern the austenite behavior in severe conditions like crash and toughness applications. Through a combination of detailed characterization of carefully selected microstructure distributions with in situ measurement techniques and micro-mechanical modelling a clear link will be established within a specific strain

rate range. Taking into account temperature dependence mostly at quasi-static level and triaxiality influencing austenite transformation near the fracture tip new insight will grow on improving material properties under these rigorous conditions.

Coordinator	*Country*	*Scientific person in charge*
CENTRE DE RECHERCHES METALLURGIQUES ASBL	BE	Mr Vincent Putterie

Partners		
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Dr Kangying ZHU
AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS	ES	Carlos GARCIA-MATEO
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	FR	Prof Sebastien ALLAIN
TATA STEEL NEDERLAND TECHNOLOGY BV	NL	Dr Radhakanta RANA
UNIVERSITEIT GENT	BE	Prof Patricia VERLEYSEN

847229 (2019)	**BIOFIRE** *Advanced Coated Steels for new demanding Biomass Firing environment having a high recycling behaviour and an improved service life*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 2,026,655.95	Start Date	01/06/2019
	EU Contribution	€ 1,215,993.57	End date	31/05/2023

Abstract

In case of firing of opportunity fuels, common solutions applied to limit risks of tube failure caused by metal loss are lowering boiler operating conditions, therefore limiting conversion efficiency, or adopting advanced boiler materials, therefore rising boiler operating costs.

Currently to increase the corrosion resistance of the boiler tubes, new steel grades are developed and this imply a possible long term application due to the stringent need of certification of the new materials for the relevant application.

The application of protective coatings which increase the harsh environment durability of the tubes onto an existing steel (e.g. T22, T91) to increase the service life of the boiler tube, on the contrary, guarantees a short term application, due to the fact that the base material has well known performances.

The coating treatments developed in BIOFIRE will enhance the environmental resistance of the existing fully qualified steels commonly used for boiler tubes for their use in power generation systems firing opportunity fuels by adopting low cost and easy handling thermochemical methods potentially applicable at industrial scale. Coating solutions, available for both inner (steam side oxidation) and outer (fireside corrosion) tubes, will lead an improvement of the boiler performance, both by reducing the outage time and maintenance expenditure resources.

The goal of this project is the development of diffusion coating treatments, to be included in the industrial manufacturing process of steel components, in order to increase the life time of the tubes up to 2 times compared to un uncoated component and the prediction of the lifetime of the coated tubes.

The project starts from a TRL5 (technology validated in relevant environment due to the experiences of the partner Flame Spray) and will arrive at TRL7 (system prototype demonstration in operational environment).

Coordinator	*Country*	*Scientific person in charge*
RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Roberta VALLE
Partners		
FLAME SPRAY HUNGARY FEMIPARI SZOLGALTATO ES KERESKEDELMI KFT	HU	Andrea CHIERICHETTI
INSTYTUT METALURGII ZELAZA IM STANISLAWA STASZICA	PL	Dr Krzysztof RADWANSKI
FUNDACION TEKNIKER	ES	Ms Elena FUENTES
BONO ENERGIA S.P.A.	IT	Dr Marco CARUGO
RWE POWER AG	DE	Mr Simon HECKMANN
ONDERZOEKSCENTRUM VOOR AANWENDING VAN STAAL NV	BE	Dr Serge CLAESSENS
SALZGITTER MANNESMANN PRÄZISROHR GMBH	DE	Dr Andreas MEISSNER

847195 (2019)	QPINOX *Development of New Martensitic Stainless Steels for Automotive Lightweight Structural Applications*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,506,097.45	Start Date	01/06/2019
	EU Contribution	€ 903,658.47	End date	30/11/2022

Abstract

This project aims to generate a new class of affordable martensitic stainless steels for the automotive sector. In detail, there are two main objectives. First, to develop new martensitic stainless steel grades containing retained austenite, using a combination of novel heat treatments (quenching and partitioning -QP) and steel chemistry optimisation, to give unique combinations of strength (>1200 MPa UTS) and ductility (total elongation more than 15%), suitable for lightweight automotive applications. The second main objective is to facilitate the industrial implementation (manufacture and use) of these new grades.

The first objective will be achieved by alloy and heat treatment design, first using models, and second via experiments, gradually scaling up from small heats with dilatometer heat treatment on small samples, to large heats followed by Gleeble heat treatment on larger hot rolled strips, and finally to lab pilot scale fully processed sheet production. At each iteration, the microstructure and mechanical properties will be assessed, in order to assist in optimization of properties in the final fully processed sheets. The second objective will be met by detailed experimental studies on critical automotive properties i.e. weldability, formability, fatigue, and corrosion. In addition, life cycle cost studies, component forming simulations, assessment of industrial processing windows, will be carried out with appropriate benchmarking to other steels, in order to assist in the industrial implementation of the developed steels. The project results are expected to benefit European stainless steel producers through the realisation of new and affordable martensitic stainless steel grades suitable for breakthrough into the lightweight automotive sector. In addition, the new grades are expected to offer attractive properties for other typical martensitic stainless steel applications such as those requiring improved corrosion and strength combinations.

Coordinator	*Country*	*Scientific person in charge*
RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Ali SMITH
Partners		
CION IMDEA MATERIALES	ES	Dr Ilchat SABIROV
TECHNISCHE UNIVERSITEIT DELFT	NL	Prof Maria SANTOFIMIA
ACERINOX EUROPA SA	ES	Mr Rafael SANCHEZ

847165 (2019)	**iNiTiAl** *Advanced implementation of novel corrosion resistant maraging steels with improved process robustness via tuned intermetallic nano-precipitation*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,969,999.00	Start Date	01/07/2019
	EU Contribution	€ 1,181,999.40	End date	31/12/2022

Abstract

This project targets an implementation and development of corrosion resistant high strength maraging

steels for two applications, i.e. a closed-die forged 1900MPa grade for aircraft landing gears for which

process robustness is the bottleneck currently, and a breakthrough lean stress corrosion resistant 1400MPa

steel for sour service. These objectives will be realised via a combination of two industrial trials to

evaluate improved processability and 3 waves of generic laboratory materials aiming at understanding

the isolated effect of single elements and intermetallic phases (mainly Ni3Ti and NiAl). Extended

dilatometry and advanced high resolution characterisation techniques are key differentiators to obtain an

in-depth insight in the precipitation of nano-sized intermetallics.

Coordinator	*Country*	*Scientific person in charge*
ONDERZOEKSCENTRUM VOOR AANWENDING VAN STAAL NV	BE	Dr Nele VAN STEENBERGE

Partners

AUBERT & DUVAL SAS	FR	Mr Denis BÉCHET
LIEBHERR-AEROSPACE LINDENBERG GMBH	DE	Mr Sebastian ZIEHM
MONTANUNIVERSITAET LEOBEN	AT	Dr Francisca MENENDEZ-MARTIN
RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Prof Wolfgang BLECK

800693 (2018)	**CRASHTOUGH** *Towards high crashworthiness parts through the investigation of microstructural effects on fracture toughness of 3rd generation AHSS*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,896,937.25	Start Date	01/07/2018
	EU Contribution	€ 1,138,162.35	End date	31/12/2021

Abstract

3rd Gen AHSS containing transformable retained austenite are excellent candidates for lightweight construction of high crashworthiness automotive parts. This is due to their complex microstructures with moderated retained austenite contents. Stress induced transformation of this retained austenite and the matrix characteristics affect both crack initiation and propagation. Crash&Tough aims to investigate and better understand such microstructural effects to optimize crash resistance in 3rd Gen TRIP-aided steels. It will be assessed through fracture mechanics based tests, advanced characterization techniques and FE modelling to phenomenologically understand crack initiation and propagation in 3rd Gen AHSS and optimize their microstructure for high crashworthiness.

Coordinator	*Country*	*Scientific person in charge*
FUNDACIO CTM CENTRE TECNOLOGIC	ES	Mr David FRÓMETA
Partners		
VOESTALPINE STAHL GMBH	AT	Mr Clemens SUPPAN
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Dr Thomas DIEUDONNÉ
CENTRO RICERCHE FIAT SCPA	IT	Dr Daniele PULLINI
LULEA TEKNISKA UNIVERSITET	SE	Dr Jörgen Kajberg

754144 (2017)	NOSTICKROLLS *Non Sticking furnace Rolls to improve service life and product quality in continuous annealing and galvanizing lines*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,059,465.00	Start Date	01/07/2017
	EU Contribution	€ 1,135,679.00	End date	31/12/2020

Abstract

The research project aims to prolong the service life of furnace rolls working in continuous annealing and galvanizing lines, bringing reduction of maintenance costs and increase of productivity by lengthening time-to-maintenance, and to improve the quality of steel strips with respect to surface defects that arise as a consequence of wear and build-up of oxides from steel product picked up by roll's surface. The most challenging issues regarding pick-up formation have arisen since the need to increase strip's running speed and/or annealing temperature and the need to process critical steel products for automotive industry, such as advanced high strength steels containing elevated levels of Mn and/or Si. The Projects objectives will be achieved by a stepwise methodological approach intended to

• Acquire systematic knowledge on the thermochemical interaction phenomena of materials in contact (roll/strip) as a function of process variables that affect the entity/rate of pick-up formation in selected industrial cases;

• Design and develop improved coating solutions using a combination of new material composition and/or new coating concepts (i.e. functionally graded coatings, multiple layered) and/or advanced and new in the field deposition techniques able to tailor all the necessary coating properties;

• Test in laboratory and pilot plant the surface functionalities of the candidate roll materials, such as pick-up, wear and thermal shock resistance, with a variety of unique in house developped testing facilities;

• Scale-up and validate the most promising solutions compared to currently used roll materials by industrial trials in CAl and CGL.

Coordinator	*Country*	*Scientific person in charge*
CENTRO SVILUPPO MATERIALI SPA	IT	Dr Nicoletta ZACCHETTI
Partners		
CENTRE DE RECHERCHES METALLURGIQUES ASBL	BE	Mr Louis BORDIGNON
FLAME SPRAY SPA	IT	Dr Walter CERRI
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Mr Emanuel THIENPONT
LWK-PLASMACERAMIC GMBH	DE	Dr Tiberius VILLICS
THYSSENKRUPP STEEL EUROPE AG	DE	Dr Marc BLUMENAU
ARCELORMITTAL ESPANA SA	ES	Mr Ramón LASO

754070 (2017)	**STEELSECO** *Design of new economic secondary precipitating steels for fatigue resistance at elevated service temperatures*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,550,177.20	Start Date	01/10/2017
	EU Contribution	€ 930,106.32	End date	31/03/2021

Abstract

The aim of this project is to investigate the microstructure evolution due to tempering of nanobainitic steels and their properties. Furthermore this project will be the first attempt to evaluate the potential of a new class of steel combining nanostructured bainitic steels with secondary precipitation.

Potential applications are subjected to elevated temperatures and require high fatigue performances at these temperatures (e.g. gas injection components, bearings, gears). Indeed, it is hoped that this yet untested combination will lead to an economical yet very high performance material for use at elevated temperatures.

Coordinator	*Country*	*Scientific person in charge*
ROBERT BOSCH GMBH	DE	Dr Matthias KUNTZ

Partners

AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS	ES	Dr Carlos GARCIA-MATEO
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	FR	Dr Julien TEIXEIRA
ASCO INDUSTRIES	FR	Dr Thomas SOURMAIL
OVAKO SWEDEN AB	SE	Dr Patrik OLUND

751360 (2017)	**HPDCSTEEL** *Development of a new steem grade to increase high pressure die casting dies life*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,413,308.15	Start Date	01/07/2017
	EU Contribution	€ 847,984.89	End date	30/06/2021

Abstract

European automotive industry, focused on the lightweight and reliability, requires sound and complex components of aluminum and magnesium produced by HPDC (High Pressure Die Casting). Steel dies are used to shape components in liquid state, but extremely high pressures (up to 1.200 bars), chemical attack of molten metal and high thermal-mechanical stresses produce premature die defects and failures. This proposal proposes to develop a new steel with a new composition that will improve the mechanical, thermal and chemical properties of the dies, enhancing the competitiveness of HPDC products and steel and European automotive industry.

Coordinator	*Country*	*Scientific person in charge*
FUNDACION TECNALIA RESEARCH & INNOVATION	ES	Dr Iban VICARIO
Partners		
LEBARIO RO SRL	RO	Mrs Marian DUMITRASCU
SCHMIEDEWERKE GROEDITZ GMBH	DE	Mr Alexander HENGST
2A SPA	IT	Claudio D'AMICO GIUSEPPE

749918 (2017)	**LIGHTCHASSIS** *Development of affordable integrated lightweight chassis components from flexible 3G medium-Mn steels*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,233,662.15	Start Date	01/07/2017
	EU Contribution	€ 1,340,198.10	End date	30/-6/2021

Abstract

The current trend in automotive industry that has been derived from regulations, fuel efficiency, safety etc. is to produce light weight car body part and chassis components. In that context the goal of this project is to design a novel medium manganese material that will be a candidate to substitute the Complex phase steels currently used in chassis component and lead to further weight reduction. The material will be designed utilizing thermodynamic and kinetic modelling to 'handpick' the compositions that are potential candidates, taking into account mechanical properties and industrial feasibility. Materials with these compositions will be belt casted and characterized with respect to microstructure and mechanical properties. The material with the optimum properties will be supplied for forming of a newly designed component. The component and forming design will be performed using industrial standards of forming and welding and advanced mechanical models that will take into account the composite microstructure. After the component is formed it will be transferred to an automotive car producer where it will be tested based on company standards providing a proof of concept.

Coordinator	*Country*	*Scientific person in charge*
RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Mr Alexandros SERAFEIM

Partners		
SALZGITTER MANNESMANN FORSCHUNG GMBH	DE	Mr Zacharias GEORGEOU
PANEPISTIMIO THESSALIAS	EL	Prof. Gregory HAIDEMENOPOULOS
CENTRO RICERCHE FIAT SCPA	IT	Dr Daniele PULLINI
INSTITUTO DE SOLDADURA E QUALIDADE	PT	Mrs Margarida PINTO
AUTOTECH ENGINEERING DEUTSCHLAND GMBH	DE	Mr Mehdi ASADI

749632 (2017)	**DUPLEXWASTE** *Lean Duplex Stainless Steel for Urban and Industrial Waste Water*			
Info	Type of Project	Research	Duration (months)	40
	Total Budget	€ 1,483,673.55	Start Date	01/09/2017
	EU Contribution	€ 890,204.13	End date	31/12/2020

Abstract

The project is dedicated to evaluating the application of lean duplex stainless steel materials for urban and industrial wastewater. Issues concerning different types of corrosion in wastewater units will be investigated by means of laboratory and field exposures. A life cycle cost assessment will be performed to assess the environmental impact of the steel types. The results will enable to establish engineering diagrams and guidelines for material selection in urban and industrial wastewater units. The project will considerably increase the market share of lean duplex stainless steels for wastewater treatment units.

Coordinator	*Country*	*Scientific person in charge*
INSTITUT DE LA CORROSION SAS	FR	Dr Dominique THIERRY
Partners		
KATHOLIEKE UNIVERSITEIT LEUVEN	BE	Prof Barbara ROSSI
APERAM STAINLESS FRANCE SA	FR	Dr Audrey ALLION
VEOLIA ENVIRONNEMENT-VE	FR	Mr Benoit EMO
CONSIGLIO NAZIONALE DELLE RICERCHE	IT	Dr Marco FAIMALI
ENDURES BV	NL	Dr Job KLIJNSTRA
OUTOKUMPU STAINLESS AB	SE	Dr Lena WREGELIUS

Technical Group Steel 4

Steel applications and solutions for existing and new markets

The scope TGA4 includes:

- Technologies relating to the transformation of steel products: cutting, forming, welding and other assembling technologies of steel products (and other materials)
- Structural safety and design methods, in particular with regard to resistance to fire and earthquakes
- Design of assembled structures to facilitate the easy recovery of steel scrap and its re-conversion into usable steels and techniques for recycling
- Steel-containing composites and sandwich structures
- Prolonging service life of steel based assemblies
- Innovative steel applications for emerging markets
- Innovative steel solutions for automobiles, packaging and home appliances
- Innovative steel solutions for building, construction, energy production and industry
- Life cycle assessment of sustainable steel applications

899299	**FIRST-WIRE** *FIber Reinforced STeel WIREs for high performance lightweight ropes and cables operating in demanding scenarios*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,888,414.19	Start Date	01/06/2020
	EU Contribution	€ 1,133,046.09	End date	31/05/2023

Abstract

FIRST-WIRE (FIber Reinforced STeel WIRE) project aims at developing a lightweight steel based wire to be used for ropes and cables for a wide range of industrial and civil where high performance over weight ratio plays a decisive role and the recourse to traditional full steel wire is unfeasible due to the excessive selfweight and/or the unsatisfactory structural performances. The proposed wire concept represents a breakthrough innovation consisting of a stainless steel wire internally reinforced with high strength/modulus carbon fibers. It combines the low weight and high mechanical performance of the fibers with the good behavior of the steel in terms of corrosion resistance, abrasion and ductility. FIRST-WIRE promotes the use of steel-based products in a market where full-composite and full-synthetic products are currently becoming very competitive. The project will consist of a wide research to prove the product performance through extensive small-scale and large-scale experimental activities, numerical simulations and case studies analysis. Among these latter, the following scenarios are selected: running ropes for off-shore ultra deep water lifting operations, mooring lines for floating platforms for wind turbines in deep water, structural cables for suspension, stayed and arch bridges.

Objectives of the proposal are summarized as follows:

1. optimization of wire design;

2. optimization of wire manufacturing process;

3. small-scale on wires and large-scale testing on ropes and cables;

4. case studies analysis to highlight the potential benefits in demanding scenarios including industrial, civil and infrastructural

applications;

5. development of design guidelines for the adoption of the innovative wire and proposal for amendments and integration in

existing European/International standards and recommendations.

Coordinator	*Country*	*Scientific person in charge*
ASTARTE STRATEGIES SRL	IT	Mr Andrea MELEDDU
Partners		
REDAELLI TECNA S.P.A.	IT	Mr Maurizio MELEDDU
NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA	GR	Prof Spyros MAVRAKOS
UNIVERSITA DEGLI STUDI DI PADOVA	IT	Dr Katya BRUNELLI
UNIVERSITA DEGLI STUDI ROMA TRE	IT	Dr Fabrizio PAOLACCI
UNIVERSITAET STUTTGART	DE	Mr Gregor NOVAK
KME GERMANY GMBH & CO KG	DE	Dr Peter BÖHLKE
IHC MTI BV	NL	Mr Hans GREVE

899321(2020)	**FREEDAM PLUS** *Valorisation of knowledge for FREE from DAMage steel connections*			
Info	Type of Project	Accompanying measures	Duration (months)	24
	Total Budget	€ 1,330,638.20	Start Date	01/07/2020
	EU Contribution	€ 1,330,638.20	End date	30/06/2022

Abstract

The main goal of the recently accomplished RFCS research project FREEDAM (RFSR-CT-2015-00022) has been the development of beam-to-column connections able to withstand destructive seismic events without any damage to the steel components. This project has raised the problem of the seismic protection of buildings with a focus on the sustainability issues, proposing a resilient and FREE from DAMage solution. The added value of the FREEDAM project to what has already been achieved at both European and worldwide level is significant. The project has led to the development of an innovative solution able to increase the safety of buildings and to reduce the direct and indirect costs related to the development of structural damage in case of rare seismic events or exceptional loads.

This proposal aims at the valorisation and the dissemination of the results achieved within the FREEDAM project. Given the importance of the outcomes raised up from FREEDAM Project, design-oriented documents (guidelines, handbook, tools and design examples) will be produced in 13 different languages, and distributed among the partners of steel construction sectors, including all academic institutions, engineers and construction companies. Moreover, workshops and seminars will be organized all over Europe, in USA and in New Zealand for presenting material, and sharing knowledge.

The current proposal is conceived in response to the need of the steel construction sector and practice in Europe for simple design tools for friction beam-to-column joints for seismic applications. With this regard, the widespread distribution of the design handbook and codified design procedures plays a key role in overcoming the intrinsic limitations of design assisted by tests in terms of both time and economical efforts and in providing reliable standard joints that can be easily used by designers.

Coordinator	*Country*	*Scientific person in charge*
UNIVERSITA DEGLI STUDI DI SALERNO	IT	Prof Vincenzo PILUSO
Partners		
UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II	IT	Prof Raffele LANDOLFO
UNIVERSITE DE LIEGE	BE	Prof Jean-Pierre JASPART
UNIVERSIDADE DE COIMBRA	PT	Prof Luis DA SILVA
UNIVERSITATEA POLITEHNICA TIMISOARA	RO	Prof Dan DUBINA
CONVENTION EUROPEENNE DE LA CONSTRUCTION METALLIQUE ASBL	BE	Ms Véronique DEHAN
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INSTITUT NATIONAL DES SCIENCES APPLIQUEES DE RENNES	FR	Prof Mohammed HIJAJ
TECHNISCHE UNIVERSITEIT DELFT	NL	Prof Milan VELJKOVIC
UNIVERZA V LJUBLJANI	SI	Prof Primoz MOZE
UNIVERSITET PO ARCHITEKTURA STROITELSTVO I GEODEZIJA	BG	Dr Nick RANGELOV
UNIVERSITAT POLITECNICA DE CATALUNYA	ES	Prof Enrique MIRAMBELL
RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Prof Benno HOFFMEISTER

899331(2020)	**IntellCutProcess** *Optimisation of cutting processes using intelligent cutting tools*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,712,906.65	Start Date	01/07/2020
	EU Contribution	€ 1,027,743.99	End date	31/12/2023

Abstract

The amount of high strength steel grades in the automotive industry has been increasing because of higher safety demands in the context with energy savings and CO2-reduction connected with the demand on light weight car body constructions. The consequences are increasing wear problems at cutting tools in the finishing departments of the European steel industry and other steel processing fields, especially the automotive industry.

The project IntellCutProcess will investigate two prevalent technologies in the field sheet metal cutting: (1) the punching as well as (2) the shearing of steel sheet. The objectives of IntellCutProcess shall be achieved by means of a holistic approach comprising the investigation/measurement of the tool wear, the influenced process parameters (cutting force, die clearance, shear angle, etc.), the optimisation of tool (material and wear protective coating), the development of sensor-equipped (intelligent) tools and the development of a predictive wear warning system.

The project objectives will be achieved by developing a multi-component solution with a wear predictive strategy consisting of:

- a wear warning system
  - optical analysis tool (cut edge evaluation),
  - measurements and analysis of important process parameters,
  - software tool for wear prediction,
- the use of adapted tool material and functional wear protective coatings,
- the use of an optimised surface topography of the tools
- the adaptation of tool geometries and process conditions.
- the modelling of punching and shearing processes

The following technical and economic advantages can be expected:

- Increased tool lifetime and thus reduced tool costs,
- Reduction of production waste due to poor cut edge quality,
- Reduction of press line downtime due to tool breakage
- Optimisation of maintenance intervals through condition-based maintenance,
- Increase of product quality,
- Improvement of process understanding.

Coordinator	*Country*	*Scientific person in charge*
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Dr Delphine RECHE

Partners		
FAGOR ARRASATE S COOP	ES	Dr Elena SILVESTRE
MONDRAGON GOI ESKOLA POLITEKNIKOA JOSE MARIA ARIZMENDIARRIETA S COOP	ES	Dr Lander GALDOS
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ADIENT METAL FORMING TECHNOLOGIES GMBH	DE	Housein DELI
G.P.A. GES. FÜR PLASMAAPPLIKATION MBH	DE	Anne LOHMANN

899371	FAILNOMORE *Mitigation of the risk of progressive collapse in steel and composite building frames under exceptional events*			
Info	Type of Project	Accompanying measures	Duration (months)	24
	Total Budget	€ 958,413.20	Start Date	01/07/2020
	EU Contribution	€ 958,413.20	End date	30/06/2022

Abstract

The main aim is to produce a set of practical and user-friendly design guidelines for mitigating the risk of progressive collapse of steel and composite structures subjected to exceptional events such as impact and explosions. This will be based on recent research projects and available normative documents in order to propose a common European design methodology. The main dissemination will be through a design manual including worked examples, which will be drafted in various national languages as well as a series of workshops in 11 European countries.

Coordinator	*Country*	*Scientific person in charge*
UNIVERSITE DE LIEGE	BE	Prof Jean-Pierre JASPART
Partners		
UNIVERSIDADE DE COIMBRA	PT	Prof Luis SIMOES DA SILVA
IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	UK	Prof Ahmed ELGHAZOULI
UNIVERSITAET STUTTGART	DE	Prof Ulrike KUHLMANN
UNIVERSITA DEGLI STUDI DI TRENTO	IT	Prof Nadia BALDASSINO
UNIVERSITATEA POLITEHNICA TIMISOARA	RO	Prof Dan DUBINA
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TECHNISCHE UNIVERSITEIT DELFT	NL	Prof Milan VELJKOVIC
UNIVERSITAT POLITECNICA DE CATALUNYA	ES	Prof Erique MIRAMBELL
INSTITUT NATIONAL DES SCIENCES APPLIQUEES DE RENNES	FR	Prof Mohammed HJIAJ
CONVENTION EUROPEENNE DE LA CONSTRUCTION METALLIQUE ASBL	BE	Mrs Véronique DEHAN
FELDMANN + WEYNAND GMBH	DE	Dr Klaus WEYNAND
ARCELORMITTAL BELVAL & DIFFERDANGE SA	LU	Dr Renata OBIALA

899381	**HYCAD** *Innovative steel-concrete HYbrid Coupled walls for buildings in seismic areas: Advancements and Design guidelines*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,240,596.70	Start Date	01/07/2020
	EU Contribution	€ 744,358.02	End date	31/12/2023

Abstract

The research project HYCAD is devoted to the development of original solutions – including analysis, design, detailing and construction –related to an innovative seismic-resistant steel-concrete hybrid coupled wall system, originally introduced among other possible innovations in the 2011-2014 RFCS research project INNO-HYCO. Such system was shown through numerical analyses and experimental tests to have very encouraging potentialities in seismic areas although more studies are indispensable to foster its adoption in the construction market. The HYCAD outcomes will include guidelines and worked examples to support the design and the application of the proposed innovative hybrid system.

Coordinator	*Country*	*Scientific person in charge*
UNIVERSITEIT HASSELT	BE	Prof Herve DEGEE
Partners		
UNIVERSITA DEGLI STUDI DI CAMERINO	IT	Prof Andrea DALL'ASTA
UNIVERSITA DI PISA	IT	Prof Walter SALVATORE
RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Prof Benno HOFFMEISTER
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OCAM S.R.L.	IT	Prof Andrea GALAZZI

847284 (2019)	**FATECO** *Improvement of the fatigue performance of automotive components through innovative ecofriendly finishing operations*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,191,963.15	Start Date	01/06/2019
	EU Contribution	€ 1,315,177.89	End date	30/11/2022

Abstract

The improvement of vehicles safety is a EU priority. The enhancement of the components performance reduces the likelihood of accidents caused by failures of these components. The FATECO project aims the fatigue and tribological performance improvement of automotive transmission parts by means of an optimized surface integrity reached through innovative finishing techniques. Additionally, some of these techniques will allow the lubricant removal, leading to a 100% ecofriendly process.

Complementary, an automatic learning approach, capable of predicting the surface integrity and the fatigue and tribological behavior, depending on input variables (material properties, process parameters…), will be developed.

Coordinator	*Country*	*Scientific person in charge*
MONDRAGON GOI ESKOLA POLITEKNIKOA JOSE MARIA ARIZMENDIARRIETA S COOP	ES	Prof Pedro-Jose ARRAZOLA

Partners		
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ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA	IT	Prof Alessandro FORTUNATO
ECOLE NATIONALE D'INGENIEURS DE SAINT-ETIENNE	FR	Prof Joel RECH

847213 (2019)	**CuttingEdge4.0** *Facing edge-cracking in AHSS: towards zero-defect manufacturing through novel material characterization and data driven analytics for process monitoring*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,510,346.40	Start Date	01/06/2019
	EU Contribution	€ 1,506,207.84	End date	30/11/2022

Abstract

Cutting operations are widely used in sheet forming. They influence post-forming operations in AHSS that are sensitive to edge damage. CuttingEdge4.0 addresses edge-cracking in AHSS by developing experimental tools and digital twins for the cutting process and incorporating Industry 4.0 data driven analytics for process monitoring. The final aim is to improve automotive industry tools to predict edge-cracking in the early part design stages. Machine learning solutions based on real-time process data will detect edge-cracking defects and assure part quality. It will permit to boost the applicability of AHSS in safety related automotive parts as a cost-efficient lightweight solution.

Coordinator	*Country*	*Scientific person in charge*
FUNDACIO CTM CENTRE TECNOLOGIC	ES	Mr Juanjo MARTIN
Partners		
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TATA STEEL NEDERLAND TECHNOLOGY BV	NL	Mr Eisso ATZEMA

800763 (2018)	**HSSF** *Hybrid Semi-Solid Forming*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,966,907.70	Start Date	01/09/2018
	EU Contribution	€ 1,180,144.62	End date	28/02/2022

Abstract

A majority of transport sector components are manufactured by forging and casting. Forging annihilates the defects and casting is more suitable for manufacturing complex geometries. The proposed novel Hybrid Semi-Solid Forming (HFFS) process utilizes the benefits of achieving a forged-like microstructure and yet provides net-shape production possibilities. It relies on hot processing in a temperature regime between forging and conventional semi-solid forming. Unlike in conventional semis-solid forming, a wide range for steels can be processed by HSSF and posited advantages include higher energy, material and cost efficiency over traditional techniques. Proposed project explores industrial viability of HSSF and investigates micromechanics.

Coordinator	*Country*	*Scientific person in charge*
MONDRAGON GOI ESKOLA POLITEKNIKOA JOSE MARIA ARIZMENDIARRIETA S COOP	ES	Dr Jokin LOZARES

Partners

CENTRO RICERCHE FIAT SCPA	IT	Dr Daniele PULLINI
SIDENOR INVESTIGACION Y DESARROLLO SA	ES	Ms Zuriñe IDOYAGA
UNIVERSITY COLLEGE LONDON	UK	Prof Peter LEE
FUNDACION CIE I+D+I	ES	Mr Iñigo Loizaga

800732 (2018)	**SCHEDULE** *Steel concrete high efficiency demonstration - European collaborative experience*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	48
	Total Budget	€ 4,486,470.30	Start Date	01/06/2018
	EU Contribution	€ 2,243,235.16	End date	31/05/2022

Abstract

SC is an innovative form of steel-concrete composite construction comprising two steel plates connected by a grid of tie bars and infilled with structural concrete. The plates act as load bearing formwork during the placement of concrete and as reinforcement to the concrete once it hardens. Composite action between the plates and the concrete is achieved through shear studs welded to the plates. SC construction is a direct competitor to reinforced concrete (RC) for wall and floor elements with the added benefit of reduced construction time due to the elimination of reinforcement and formwork fixing, elimination of formwork removal and the ability to maximise parallel activities through offsite construction. In industrial applications, where large numbers of electrical and mechanical items are supported from the structure, SC construction eliminates the complex and time consuming installation of embedded plates in RC leading to further time and cost saving.

A recent RFCS project (SCIENCE, 2017) produced comprehensive European design rules for SC structures. It also showed that structure volume can be reduced using SC compared to RC, leading to CO2 emissions reduction. What is now needed to promote the industrial exploitation of SC construction is a demonstration of the time and cost savings at a realistic scale.

The aim of this pilot project is to document the efficiency of SC by constructing a replica of a building forming part of a nuclear power plant. This has been chosen as the nuclear sector (where buildings and containment structures are currently built from reinforced or post-tensioned concrete) offers significant potential for SC. The project will address the challenges of SC module fabrication, erection, joining and concreting. All civil and structural works will be monitored and both time and cost will be recorded. The lessons learnt will be readily transferable to other applications such as core walls in tall buildings, retaining walls, bridges, etc.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	FR	Mr Pierre SAUNIER
EGIS INDUSTRIES SA	FR	Mr Jean Luc TUSCHER
BOUYGUES TRAVAUX PUBLICS SA	FR	Mr Denis ETIENNE
UAB PEIKKO LIETUVA	LT	Mr Saulius GRIGAS
ONDERZOEKSCENTRUM VOOR AANWENDING VAN STAAL NV	BE	Dr Martin Liebeherr

800726 (2018)	**STEEL S4 EV** *STEEL Solutions for Safe and Smart Structures of Electric Vehicles*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,936,648.10	Start Date	01/09/2018
	EU Contribution	€ 1,161,988.86	End date	31/08/2021

Abstract

STEEL S4 EV aims at putting high strength steel at the forefront of a new trend in electric vehicles: light vehicles with three or four wheels that comply with crash regulation and with more restrictive Euro NCAP demands. Weld joint design and welding methodologies research to keep material properties along the joints assuring robustness and long term durability. To do this cost competitively low investment manufacturing will be achieved by a modular and flexible structural design: a complex 3D skeleton frame of welded tubes, bent with high accuracy using programmed laser cuts will enable different vehicles sharing the same tooling.

Coordinator	*Country*	*Scientific person in charge*
FUNDACION CIDAUT	ES	Mr Javier ROMO

Partners		
INTERACTIVE FULLY ELECTRICAL VEHICLES SRL	IT	Dr Pietro PERLO
BELGISCH INSTITUUT VOOR LASTECHNIEK VZW	BE	Dr Koen FAES
LULEA TEKNISKA UNIVERSITET	SE	Dr Esa VUORINEN
MA SPA	IT	Dr Jean LAMONTANARA
THINKSTEP AG	DE	Mr Alexander FORELL

800699 (2018)	**DISSIPABLE** *Fully dissipative and easily repairable devices for resiliern buildings with composite steel-concrete structures*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	36
	Total Budget	€ 1,814,811.65	Start Date	01/06/2018
	EU Contribution	€ 907,405.82	End date	31/05/2021

Abstract

Anti-seismic devices previously designed and characterized within RFCS Projects by the proposal's authors will be further developed taking into account the experience collected so far. Optimized structural systems will be proposed, with improved dissipation, reliability and reparability features. Single storey buildings with seismic resistance provided by the improved devices will be built and subjected to strong earthquakes. Systematic post-earthquake repair and reassembly procedures for these buildings applied and provided as "instructions for use". Ability of repaired systems to resist strong earthquakes will be examined. Economic and environmental benefits and improved resiliency properties of the proposed systems will be quantified.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
INSTITUTO SUPERIOR TECNICO	PT	Prof Luis CALADO
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D. SOFRAS - MASINA TEAM ANONIMI ETAREIA METALLIKON & MIKANOYRGIKON ERGASION	EL	Mr Michalis SOFRAS
UNIVERSITA DEGLI STUDI DI TRENTO	IT	Prof Oreste Bursi
RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Prof Benno HOFFMEISTER
RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Giuliana Zilli
UNIVERSITA DI PISA	IT	Prof Walter SALVATORE

800687 (2018)	**DESDEMONA** *Detection of steel defects by enhanced monitoring and automated procedure for self-inspection and maintenance*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 2,200,885.75	Start Date	01/06/2018
	EU Contribution	€ 1,320,531.45	End date	31/05/2021

Abstract

DESDEMONA objective is the development of novel design methods, systems, procedure and technical solution, to integrate sensing and automation technologies for the purpose of self-inspection and self-monitoring of steel structures. The approach will lead to an increment of the service life of existing and new steel civil and industrial infrastructure and to a decrease in the cost associated to inspections, improving human activities performed in difficult conditions, safety and workers' potential by the use of advanced tools.

The research aims to expand beyond the current state-of-the-art new high-quality standard and practices for steel structure inspection and maintenance through the interrelated development of the following actions: i) steel structure geometry and condition virtualization through data fusion of image processing, thermography and vibration measurements; ii) developing of procedure for steel defect detection by robotic and automatic systems such as Unmanned Aerial Vehicles (UAV) and ground mobile robots iii) embedding sensor systems to revalorize and transform steel elements and structures into self-diagnostic (smart) elements and materials even through nanotechnologies, iv) realizing an experimental lab-based apparatus and a series of case studies inspected by intelligent and robotic systems.

The project outcome will have an impact on the reduction of the cost of steel structures inspection and maintenance and on the increase of user safety and comfort in industrial and civil environment. The proposal with a multidisciplinary approach fulfils the objectives of the Strategic Research Agenda of the European Steel Technology Platform.

Coordinator	*Country*	*Scientific person in charge*
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UNIVERSIDADE DO PORTO	PT	Prof Alvaro CUNHA
UNIVERSITA DI PISA	IT	Prof Walter SALVATORE
INSTITUT FRANCAIS DES SCIENCES ET TECHNOLOGIES DES TRANSPORTS, DE L'AMENAGEMENT ET DES RESEAUX	FR	Dr Jean DUMOULIN
AIVIEWGROUP SRL	IT	Dr Nicola MARIETTI
SIXENSE SYSTEMS	FR	Dr Gilles HOVHANESSIAN
ECISA COMPANIA GENERAL DE CONSTRUCCIONES SA	ES	Ms Vanessa IZQUIERDO

800649 (2018)	**WARMLIGHT** *Development of a methodology for lightweight design of warm formed components with complex geometries in heavy vehicle applications*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,922,626.80	Start Date	01/09/2018
	EU Contribution	€ 1,153,576.08	End date	28/02/2022

Abstract

The aim of the project is to develop a methodology for simulation based design of thick-walled components for trucks and other heavy machinery in the transport sector. The objective of the project is to enable weight-optimized components with complex geometries, meeting advanced requirements regarding the fatigue properties by avoiding assemblies and welded joints. The methodology of warm forming and a FE-simulation based forming process design is applied with new ultra-high strength (UHSS) steel grades for warm forming evaluated within the project. A process chain is defined in which the developed steel grade is combined with down-stream thermo-mechanical processes. The process chain will involve a sequence of processes steps performed at the steel manufacturer, in the hot forming process and operations at the OEM. The methodology will be fully supported by modelling and simulation, including microstructural predictions, forming simulations and final property assessments. The objectives are to: • Develop a predictive simulation methodology that supports an optimal design of a warm forming process in order to meet the performance and lightweight demands of the HDV sector. • Optimize a thermo-mechanical forming process (warm forming) for manufacturing of components that meets the demands with respect to strength, elongation and fatigue limit • Screening, evaluation and selection of new steel grades for warm forming of thick-walled components for forming of thick-walled components with complex geometries, based on alloying concepts for steel grades that are currently used for applications in industry. The ultimate target is a yield limit over 1150 MPa and elongation of more than 15% after warm forming. • Develop a demonstrator component fulfilling strength and fatigue resistance requirements and with 25 % weight reduction compared with traditional technologies. • Perform a complete and detailed LCA to validate the sustainability of the proposed solutions.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
FUNDACIO CTM CENTRE TECNOLOGIC	ES	Prof Daniel CASELLAS
VOESTALPINE STAHL GMBH	AT	Mr Reinhard HACKL
SCANIA CV AB	SE	Dr Henrik SIEURIN
CENTRO RICERCHE FIAT SCPA	IT	Dr Daniele PULLINI
VOESTALPINE STEEL & SERVICE CENTER GMBH	A	Dr Christian PRAMHAS

799787 (2018)	**LIGHTTECH** *Innovative approaches of stress shot peening and fatigue assessment for the development of lightweight, durability-enhanced automotive steel leaf springs.*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,738,363.65	Start Date	01/09/2018
	EU Contribution	€ 1,043,018.19	End date	28/02/2022

Abstract

The project aims at creating a novel R&D platform for accurate durability enhancement and assessment of automotive components made of high-strength steels, focusing here on leaf springs. The main technological project objectives are:

1. Development of a sophisticated elastoplastic FEM-based Stress Shot Peening (SSP) simulation model for systematic and reproducible elaboration of optimized SSP process parameters for enhanced product durability.

2. Development of a modularly structured, analytical fatigue life calculation model, applicable in any stage of development depending on the input data level (material data / leaf specimen data / full-scale component prototype data), independent or in conjunction with the SSP simulation model.

3. Creation of a experimental database that will be used for the input and comprehensive validation of the above theoretical models.

4. Development of two lightweight, high-performance full-scale leaf springs, with exceptional strength and fatigue performance, not attainable with the current technologies, both of high industrial interest, demonstrating the remarkable industrial exploitation potential of the above mentioned models. A huge impact of the project outcomes is expected: Development times, currently counted in years, will be shortened down to few months. Reproducibility, high quality and effectiveness will give credence and big added-value to the final products, crossing the current thresholds in the development of springs with highest requirements of lightweight, safety and durability. The competitiveness of the (currently balky) position of the European leaf spring industry and the associated European steel producers will be significantly strengthened against their non-European competitors. Starting from the leaf spring branch, the developed models will be applicable to further high-strength steel components, especially the ones with graded surface properties due to their surface treatment.

Coordinator	*Country*	*Scientific person in charge*
ARISTOTELIO PANEPISTIMIO THESSALONIKIS	EL	Prof Georgios SAVAIDIS
Partners		
SAARSTAHL AG	DE	Dr Georg DOPPLER
SOGEFI SUSPENSIONS HEAVY DUTY ITALY S.R.L.	IT	Mr Peter KINZEL
MUELLES Y BALLESTAS HISPANO ALEMANAS PROJECTS SL	ES	Mr Javier ISACH
MAN TRUCK & BUS AG	DE	Mr Jose CAMPOS-HERNANDEZ
DEMOCRITUS UNIVERSITY OF THRACE	EL	Prof Georgios MALLIARIS
HOCHSCHULE BOCHUM	DE	Prof Eckehard MÛLLER

754198 (2017)	**TRAFIR** *Characterization of travelling fires in large compartments*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,199,975.10	Start Date	01/07/2017
	EU Contribution	€ 719,985.06	End date	31/12/2020

Abstract

Many studies of fires in large compartments reveal that they do not burn uniformly throughout the enclosure. They tend to travel and lead to highly non-uniform temperatures which implies a transient heating of the structure. Travelling fires are not considered in the Eurocodes : the main limit in developping models is the lack of large scale, realistic test results. This project aims to realize such tests and performing numerical simulations to define the conditions in which travelling fires develop, to build an analytical model which evaluate the thermal effect and to create design guidance which improves structural safety.

Coordinator	*Country*	*Scientific person in charge*
ARCELORMITTAL BELVAL & DIFFERDANGE SA	LU	Mrs Marion CHARLIER

Partners		
UNIVERSITE DE LIEGE	BE	Prof Jean-Marc FRANSSEN
RISE RESEARCH INSTITUTES OF SWEDEN AB	SE	Dr David LANGE
THE UNIVERSITY OF EDINBURGH	UK	Dr Stephen WELCH
UNIVERSITY OF ULSTER	UK	Prof Ali NADJAI

754185 (2017)	**HAIR** *Improved durability of steel sandwich panel constructions regarding hygrothermal and airtightness Performance*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,341,565.70	Start Date	01/07/2017
	EU Contribution	€ 804,939.42	End date	30/06/2020

Abstract

HAIR is concerned with safeguarding the durability of steel intensive building envelopes against thermal and moisture related hygrothermal failures of the type that are increasing common, in part as a consequence of the more widespread use of well insulated construction. The project concentrates on investigations and solutions to prevent condensation and corrosion effects at steel sandwich construction, which have been increasing in recent years throughout Europe. Improved solutions in relation to both new build and refurbishment will be developed to produce reliable design methods and practical guidance for avoidance of failures in the future. As a consequence, the work will reduce the levels of risk associated with hygrothermally induced premature corrosion of steel sandwich panel constructions, and moisture related degradation of non-steel elements such as insulation materials and internal linings. The project also focusses on renovating and repowering of existing buildings by over-cladding with steel sandwich panel constructions. Especially, the impact on the building physics performance due to changing the envelope properties and interactions between heat, air and moisture on element level are regarded. The conducted investigations are raised from element to building level in order to extend applications of steel sandwich panel constructions to a wider use for several building types, climatic conditions and user profiles. In this way, the whole building performance of the systems will be investigated and assessed with regard to their influence on the durability, energy efficiency and life cycle performance of hall-like buildings. In addition to the development of explicit solutions, the principles of durable steel sandwich panel constructions will be summarised in guidelines.

Coordinator	*Country*	*Scientific person in charge*
RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Prof. Markus KUHNHENNE
Partners		
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RUUKKI CONSTRUCTION OY	FI	Dr Jyrki KESTI
ARCELORMITTAL MAIZIERES RESEARCH SA	FR	Dr Roberto TURCONI
TRIMO ARHITEKTURNE RESITVE D.O.O	SI	Dr Boštjan ČERNE
OXFORD BROOKES UNIVERSITY	UK	Prof Raymond OGDEN
IFBS EV	DE	Dipl Ing Kai KAHLES

754155 (2017)	**STIFFCRANK** *Advanced laser surface hardening of microalloyed steels for fatigue enhancement of automotive engine components*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,723,041.35	Start Date	01/07/2017
	EU Contribution	€ 940,813.41	End date	31/12/2020

Abstract

Fatigue strength of crankshafts needs to be improved to meet today's demands of higher performance automotive engines. In some cases, fatigue improvement can be difficult to reach due to poor residual stress distributions in relation to non-uniform/heterogeneous surface strengthened layers produced by standard techniques (induction surface hardening -IH- and deep rolling –DR-). In addition, the limited flexibility and complexity of equipment used for IH and DR may also hamper building next generation of high-performance engine crankshafts. STIFFCRANK will propose a novel laser-based processing strategy for surface hardening of microalloyed steel components, aimed at imparting an optimum distribution of residual stresses under the surface by generating uniform and homogenous hardened layers for improving fatigue resistance of the final steel component. The new strategy will involve using Advanced Laser Surface Hardening (ALSH) techniques for tailoring the energy distributed over the surface area and overcoming the limitations of conventional laser-surface hardening methods due to tempering of overlapped tracks during multi-pass laser beam hardening. Different options of laser processing technology will be employed, such as Laser Linear Oscillation Scanning (LLOS) and Beam shaping, for distribute the laser energy and induced optimum residual stress profiles. In STIFFCRANK, experimental and simulation tests will be combined with extensive measurements of the residual stress profile, detailed microstructural analysis and bending fatigue tests of advanced laser surface hardened steels and crankshafts. At the end of the project, the most promising conditions will be demonstrated by bench testing of full-size crankshafts.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
SIDENOR INVESTIGACION Y DESARROLLO SA	ES	Mr Rafael PIZARRO
UNIVERSITAET KASSEL	DE	Prof Thomas NIENDORF
LULEA TEKNISKA UNIVERSITET	SE	Prof Alexander KAPLAN

754102 (2017)	**STEELWAR** *Advanced structural solutions for automated steeelrack supported warehouses*			
Info	Type of Project	Research	Duration (months)	48
	Total Budget	€ 2,455,459.80	Start Date	01/07/2017
	EU Contribution	€ 1,473,275.88	End date	30/06/2021

Abstract

Automated Rack Supported Warehouses (ARSW) represent the future of storage technology, providing substantial savings in terms of cost, space and energy with respect to traditional warehouses. Currently, designers refer to building codes, without any control of their correct applicability to the specific typologies of these peculiar steel structures. This creates important safety and efficiency problems because ARSWs' structural characteristics are considerably different from those of normal steel structures for buildings. Basing on an accurate evaluation of safety level of the design concepts actually adopted in current practice (in the total absence of specific design codes), the main objective of the proposal is the definition of dedicated innovative design approaches for ARSWs in not seismic and seismic conditions. In particular, attention will be focused on loading conditions that characterize the ARSWs during its installation and service life and on ductile design under seismic loading. Based on such analysis specific design rules and recommendations will be carried out for erection and design of ARSWs.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Prof Benno HOFFMEISTER
NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA	EL	Prof Ioannis VAYAS
NOEGA SYSTEMS SOCIEDAD LIMITADA	ES	Mr Gregorio FERNANDEZ
SYSTEM LOGISTICS S.P.A.	IT	Dr Giampaolo BORDINI
SACMA SPA	IT	Mr Filippo DELLADONNA
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FINCON CONSULTING ITALIA SRL	IT	Prof CARLO CASTIGLIONI
UNIVERSITA DEGLI STUDI DI FIRENZE	IT	Prof Gianni BARTOLI
NEDCON BV	NL	Mr Jan HERMANEK
MECALUX S.A.	ES	Mr Pedro DOT

754092 (2017)	**GRISPE PLUS** *Valorisation of knowledge for specific profiled steel sheets,*			
Info	Type of Project	Accompanying Measures	Duration (months)	18
	Total Budget	€ 818,775.25	Start Date	01/07/2017
	EU Contribution	€ 491,261.87	End date	31/12/2018

Abstract

The core objective of GRISPE+ is the promotion, dissemination, valorization and use in practice of the knowledge, technical guidelines, calculation methods, background information obtained on, and codification proposals made for, 7 families of economic, environmentally friendly and safe steel profiles in the RFCS funded project No RFSR-CT-2013-00018 “Guidelines and Recommendations for integrating specific profiled steel sheets in the Eurocodes (GRISPE)" by means of high-impact, innovative dissemination tools including e-tools (structured online database, eLectures, e-networks, input to web-based media) and valorization activities such as strategically located dissemination workshops.

It also gives the opportunity to promote the use of cold-formed thin-gauge elements in the construction market.

In addition, in the context of the on-going process of evolution of the Eurocodes, GRISPE+ will seek to pursue the dialogue with CEN TC250/SC3/WG3 in order to further contribute to the technical issues raised and to help with the ongoing process of incorporating GRISPE and GRISPE+ outputs into the Eurocode EN 1993-1-3

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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STOWARZYSZENIE WYKONAWCOW DACHOW PLAKISCH I FASAD	PL	Mrs Katarzyna WIKTORSKA
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RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Prof Markus KUHNHENNE
SOKOL PALISSON CONSULTANTS SARL	FR	Mrs Anna PALISSON
TTY-SAATIO	FI	Prof Markku HEINISUO
UNIVERSITA DI PISA	IT	Prof Walter SALVATORE

754072 (2017)	**LOCAFIPLUS** *Temperature assessment of a vertical steel member subjected to localised fire - Valorisation*			
Info	Type of Project	Accompanying Measures	Duration (months)	18
	Total Budget	€ 813,701.55	Start Date	01/07/2017
	EU Contribution	€ 813,700.65	End date	31/12/2018

Abstract

LOCAFI+ represents the valorisation project of LOCAFI whose main objective was to provide designers calculation methods with scientific evidence that will allow them to design steel columns subjected to localised fires such as those that may arise, for example, in car parks. In fact, at the time being, such evidence, models and regulations exist for beams located under the ceiling, but nothing is available for columns, and this situation may lead to unnecessary and excessive thermal insulation that jeopardizes the competitiveness of whole steel projects.

Within LOCAFI, number of tests and numerical investigations enabled to gain comprehensive understanding of the involved phenomena that led to the quantification of convective and radiative heat fluxes received by a column subjected to a localised fire. This combination of experimental and numerical investigation also led to the definition of two calculation methods: (i) a quite complex method implemented into FE software; (ii) a simplified method implemented into the existing user-friendly free software OZone and aimed at being introduced into the Eurocodes.

The technical objective of LOCAFI+ is to disseminate the methodology for the fire design of columns under localised fire to practicing engineers in various countries by exploiting the results obtained in LOCAFI. The transfer of the developed calculation methods into practice will be achieved by national seminars and clearly structured design manuals.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
CENTRE TECHNIQUE INDUSTRIEL DE LA CONSTRUCTION METALLIQUE	FR	Dr Bin ZHAO
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UNIVERSITE DE LIEGE	BE	Prof Jean-Marc FRANSSEN
UNIVERSITY OF ULSTER	UK	Prof Ali NADJAI
UNIVERSITA DEGLI STUDI DI TRENTO	IT	Dr Nicola TONDINI
CESKE VYSOKE UCENI TECHNICKE V PRAZE	CZ	Prof Frantisek WALD
STICHTING BOUWEN MET STAAL	NL	Dr Ralph HAMERLINCK
UNIVERSIDADE DE AVEIRO	PT	Prof Paulo VILA REAL
BAUFORUMSTAHL EV	DE	Dr Bernhard HAUKE
TALLINNA TEHNIKAULIKOOL	EE	Dr Ivar TALVIK
UNIVERZA V LJUBLJANI	SI	Dr Primoz MOZE
INSTYTUT TECHNIKI BUDOWLANEJ	PL	Dr Andrzej BOROWY
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TECHNICKA UNIVERZITA V KOSICIACH	SK	Dr Mohamad AL ALI
STAALINFOCENTRUM – INFOSTEEL	BE	Mr Koen MICHIELSEN

754048 (2017)	**EQUALJOINTS-PLUS** *Valorisation of knowledge for European pre-qualified steel joints*			
Info	Type of Project	Accompanying Measures	Duration (months)	24
	Total Budget	€ 1,218,711.55	Start Date	01/07/2017
	EU Contribution	€ 1,218,711.55	End date	30/06/2019

Abstract

Within the previous RFCS project EQUALJOINTS (RFSR-CT-2013-00021), seismic prequalification criteria of steel joints have been developed. This proposal aims at the valorisation, the dissemination and the extension of the developed prequalification criteria for practical applications to a wide audience (i.e. academic institutions, Engineers and architects, construction companies, steel producers).

The main objectives of the proposal are the following:

• To collect and organize informative material concerning the prequalified joint typologies: informative documents will be prepared in 12 languages (English, Spanish, French, German, Italian, Dutch, Portuguese, Czech, Bulgarian, Romanian, Greek, and Slovenian);

• To develop pre-normative design recommendations of seismically qualified joints on the basis of results from Equaljoints project;

• To develop design guidelines in order to design steel structures accounting for the type of joints and their relevant non-linear response;

• To develop a software and an app for mobile to predict the inelastic response of joints;

• To organize seminars (2) and workshops (14) for disseminating the gained knowledge over EU and internationally. Workshops and seminars will be organized in the own-countries of partners involved in the project as well as in United States of America (USA). With this regard, since in EQUALJOINTS dog-bone joints with heavy sections have been qualified using US shapes produced in Europe, the organization of seminars in USA will be an important opportunity to get to the US Market, consolidating the gain of European economy and having beneficial impact on exportation of European products in USA;

• To create a web site with free access to the users in order to promote the obtained results;

• To create a You-Tube channel to make available the videos of the experimental tests and simulations to show the evolution of damage pattern.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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UNIVERSITE DE LIEGE	BE	Prof Jean-Pierre JASPART
UNIVERSITET PO ARCHITEKTURA STROITELSTVO I GEODEZIJA	BG	Prof Jordan IVANOV MILEV
CESKE VYSOKE UCENI TECHNICKE V PRAZE	CZ	Prof Frantisek WALD
RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	DE	Prof Benno HOFFMEISTER
NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA	EL	Prof Ioannis VAYAS
UNIVERSITAT POLITECNICA DE CATALUNYA	ES	Prof Enrique MIRAMBELL
CENTRE TECHNIQUE INDUSTRIEL DE LA CONSTRUCTION METALLIQUE	FR	Dr Pierre-Olivier MARTIN
UNIVERSITA DEGLI STUDI DI SALERNO	IT	Prof Vincenzo PILUSO

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TECHNISCHE UNIVERSITEIT DELFT	NL	Prof Milan VELJKOVIC
UNIVERSIDADE DE COIMBRA	PT	Prof Luis DA SILVA
UNIVERSITATEA POLITEHNICA TIMISOARA	RO	Prof Dan DUBINA
UNIVERZA V LJUBLJANI	SI	Dr Primoz MOZE
IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	UK	Prof Ahmed ELGHAZOULI

753993 (2017)	**ANGELHY** *Innovative solutions for design and strengthening of telecommunications and transmission lattice towers using large angles from high strength steel and hybrid techniques of angles with FRP strips.*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,220,392.50	Start Date	01/07/2017
	EU Contribution	€ 732,235.50	End date	31/12/2020

Abstract

Angle sections are extensively used in lattice towers and masts for telecommunication or electricity transmission. In addition, single or built-up sections made of angles are used in a wide field of civil engineering applications including buildings, bridges or for strengthening existing structures. However, there is a lack of consistent European rules for design for members made of angle profiles. Recent developments have led to a wider application of large angle sections made of high strength steel, for which European design rules are missing. Due to increasing loads, strengthening of existing towers, especially for communication, is an issue faced in everyday practice. However, design codes cover only one specific configuration.

The objective of this proposal is the development of design rules that exploit the carrying potential of angle sections, including large angles from high strength steel, the improvement of existing rules for built-up sections and the incorporation of innovative types of built-up sections composed of two angles with unequal sections. In addition, hybrid profiles composed of angle sections and FRP plates will be investigated and relevant design rules developed. Such hybrid members provide innovative and cost effective solutions for strengthening existing lattice towers. Experimental and numerical investigations will be performed at the level of cross sections, members, as well as of structural tower sub-assemblies to incorporate the influence of realistic connection conditions, existing eccentricities and load shedding between tower walls. Case studies will be examined and a performance-based assessment of the actual system safety will be conducted incorporating uncertainties in loads, material and geometry. A comprehensive evaluation of the reliability infused by the new design rules will be made. The proposed rules will be integrated in design software for towers.

Coordinator	*Country*	*Scientific person in charge*
NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA	EL	Prof Ioannis VAYAS
Partners		
ARCELORMITTAL BELVAL & DIFFERDANGE SA	LU	Mrs Francoise LABORY
UNIVERSITE DE LIEGE	BE	Prof Jean-Pierre JASPART
COSMOTE KINITES TILEPIKOINONIES AE	EL	Mrs Aggeliki PAPAILIOPOULOU
CENTRE TECHNIQUE INDUSTRIEL DE LA CONSTRUCTION METALLIQUE	FR	Mr Alain BUREAU
SIKA FRANCE SAS	FR	Mr Yvon GIQUEL

751583 (2017)	STABFI *Steel cladding systems for stabilization of steel buildings in fire*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,438,020.85	Start Date	01/07/2017
	EU Contribution	€ 862,812.51	End date	30/06/2020

Abstract

It has been shown in a recent project that considerable savings can be achieved for structural members, columns, beams and trusses, if sandwich panels and trapezoidal sheeting are used for stabilizing the whole structure, compared to the case when stability is ensured by other means. The question addressed here is: can we achieve similar savings in fire due to this stabilizing effect? Until now stabilization with these cladding structures has been used only without fire. The project offers innovation of using it also during fire, which is expected to lead to considerable savings in costs and carbon emissions for steel structures in competition against other materials in buildings.

Coordinator	*Country*	*Scientific person in charge*
TTY-SAATIO	FI	Prof Markku HEINISUO

Partners		
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BUDAPESTI MUSZAKI ES GAZDASAGTUDOMANYI EGYETEM	HU	Prof Laszlo HORVATH
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HAMEEN AMMATTIKORKEAKOULU OY	FI	Mr Jarmo HAVULA
SFS INTEC OY	FI	Mr Kari RINTAMÄKI
CITY UNIVERSITY OF LONDON	UK	Prof Kuldeep VIRDI
KINGSPAN A.S.	CZ	Mr Milan PATZELT

749959 (2017)	**INNO3DJOINTS** *Innovative 3D joints for robust and economic hybrid tubular construction*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,483,735.50	Start Date	01/07/2017
	EU Contribution	€ 890,241.30	End date	30/06/2020

Abstract

The main goal of INNO3DJOINTS is to develop innovative plug-and-play joints for hybrid tubular construction, whereby tubular columns are combined with cold-formed lightweight steel profiles to provide a highly efficient structural system. For this, the following objectives will be fulfilled:

• Development of a design procedure in the framework of the component method for innovative plug-and-play joints. This is currently not addressed in the structural eurocode and consistency with the component method will always be kept. This is accomplished by carrying out extensive experimental and numerical studies. These are carried out both at the joint level and at the component level;

• Codifying the design procedures for cold-formed connections (EC3-1-3) in a completely consistent format with the component method and EC3-1-8 – which is also currently not achieved;

• Characterization of particular aspects of joints involving cold-formed tubular sections. Influences of manufacturing procedures in the behavior of the profile. Influences of the corner welded region on the welding of the plug-and-play connection;

• Implementation of a general procedure for tackling the 3D behaviour of these particular steel joints, essential to deal with robustness issues. A generalized finite element that includes all studied components of the design model for joints with 3D behaviour is developed and further implemented in a software tool – firstly for analysis of the connection itself and secondly for the overall structural building analysis. Although this aspect may be further extendable to other types of cross sections and fabrication procedures, in this project focus is only given to the hybrid connections.

Finally, the project demonstrates the suitability of the hybrid system including the innovative joints for low to medium-rise buildings under normal and accidental actions (fire and seismic) through representative case studies, using the developed methodologies.

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FERPINTA - INDUSTRIAS DE TUBOS DE ACO DE FERNANDO PINHO TEIXEIRA SA	PT	Mr Bruno MARQUES
FAMETAL-FABRICA PORTUGUESA DE ESTRUTURAS METALICAS SA	PT	Mr Helder FRADE

747847 (2017)	**PROGRESS** *Provisions for Greater Reuse of Steel Structures*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,664,995.75	Start Date	01/06/2017
	EU Contribution	€ 998,997.45	End date	31/05/2020

Abstract

The PROGRESS project will provide methodologies, tools and recommendations on reusing steel-based components from existing and planned buildings. The project particularly targets the design for deconstruction and reuse of envelopes, load-bearing frames, trusses and secondary elements of single-storey buildings framed in steel. This building type has broad applicability as industrial, commercial, sports, exhibition, warehouse facilities, and shows most potential in suitability for reuse and viability for circular-economy business models. The whole life benefits of reusable single-storey steel buildings will be quantified from environmental and economic viewpoints. The outcomes will be extensively disseminated in particular among manufacturers, designers, contractors and researchers.

Implementation of a circular economy involving essentially closed material loops is only starting to take the first steps. The strong industrial motivation in the project is based on the need to establish novel profitable business ecosystems and to increase competitiveness of steel products. Our consortium proposes to develop technologies and business models in the steel construction sector to address the most significant needs in the business and society.

The project offers a completely new point of view on the design and execution of buildings and manufacture of construction products. They will be no longer considered as end products, but instead in the scope of circular economy as a part of continuous chain of the products ecosystem. The construction and demolition waste will became a new resource to be considered in the future buildings design.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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RUUKKI CONSTRUCTION OY	FI	Dr Jyrki KESTI
UNIVERSITATEA POLITEHNICA TIMISOARA	RO	Prof Dan DUBINA
THE STEEL CONSTRUCTION INSTITUTE LBG	UK	Dr Michael SANSOM

747346 (2017)	**LEAFSLIM** *Lightweight steel Leaf Springs with improved durability and reliability*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,519,811.20	Start Date	01/07/2017
	EU Contribution	€ 911,886.02	End date	30/06/2020

Abstract

EURO-VI directive for emission reduction forces to cut weight of trucks, vans and other LCV and HCV. In particular, this means to reduce weight of suspension leaf springs. Despite the effort made up to date, further weight reductions must be achieved. Leaf springs currently are made with CrV steel grades, that are hot rolled, quenched and tempered and stresspeened.

To make feasible a leaf spring downweighting and cope with higher bending stresses, two approaches are possible: the optimization of residual stresses due to complex stresspeening process and the development of ultra high strength steels. The interactions and synergies between innovative complex stress peening processes and novel ultra high strength leaf spring steels will be studied at experimental and industrial scale, with the aim of lightening these components, guaranteeing an outstanding fatigue performance.

The aim of LEAFSLIM project is the weight reduction of the leaf springs for suspensions of light and heavy duty commercial vehicles through:

• Development of novel steel grades for lightweight leaf spring applications;

• Optimization of the Residual Stress profile through innovative stresspeening processes to achieve an enhanced profile of residual stresses, smoother surface roughness and relaxation resistance;

• Improvement of fatigue performance of the final components through a decrease in crack propagation rate within the residual stress field;

• Development of a Woodvine-analysis including the transient physical mechanisms of the peening processes derived from the residual stress profile and the microstructure of the new steel in order to predict fatigue lifetime and fatigue damage.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
KARLSRUHER INSTITUT FUER TECHNOLOGIE	DE	Dr Stefan DIETRICH
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ARISTOTELIO PANEPISTIMIO THESSALONIKIS	EL	Prof Georgios SAVAIDIS
MUELLES Y BALLESTAS HISPANO ALEMANAS PROJECTS SL	ES	Mr Javier ISACH

747266 (2017)	**INNOFAT** *Innovative approach to improve fatigue performance of automotive components aiming at CO2 emissions reduction*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,785,311.20	Start Date	01/07/2017
	EU Contribution	€ 1,071,186.72	End date	31/12/2020

Abstract

Cars are responsible of 25% of CO2 emissions in the EU. To reduce these emissions, EU established a mandatory target, to be reached in 2020, of 95 g CO2/km (30% lower than the average CO2 emissions in 2012).

Vehicle lightweight is the main alternative to reduce CO2 emissions. Crankshaft is the heaviest special steel component in a vehicle. So, its weight reduction potential is high. The crankshaft downsizing must be performed taking into account that engine torque can not be reduced. So, if crankshaft is downsized, the steel fatigue limit must be increased to guarantee the required crankshaft in-service performance.

This INNOFAT project is focused on crankshafts manufactured with microalloyed steels, but the obtained results may be extrapolated to other automotive components (camshafts, gears, common-rails...).

Two different approaches are considered to improve the component fatigue performance: 1) steels with improved isotropy and 2) steels with higher strength. In the first case, different isotropy levels will be evaluated to determine which of them leads to the best fatigue performance. The second approach is based on a new high strength microalloyed steel (UTS>1.050 MPa) up to now only manufactured at laboratory scale.

Along the INNOFAT project, the crankshafts manufacturing process (from hot forging to different machining operations) will be studied at laboratory scale. Finally, the most suitable steel from each approach will be chosen to manufacture and test real crankshafts in order to estimate the weight reduction that could be achieved.

At the end of the project, some guidelines will be elaborated in order to facilitate the industrial implementation of the developed steels.

Coordinator	*Country*	*Scientific person in charge*
SIDENOR INVESTIGACION Y DESARROLLO SA	ES	Dr Diego HERRERO VILLALIBRE

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745982 (2017)	FASTCOLD *Fatigue strength of cold-formed structural steel details*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,873,935.80	Start Date	01/07/2017
	EU Contribution	€ 1,724,361.48	End date	31/12/2020

Abstract

Fatigue design rules for cold-formed steel sections and details are completely missing on a European level. EN 1993-1-3, deals only with the static design of cold-formed thin-walled sections. Its commentaries, and related design manuals, do not even mention fatigue design. EN1993-1-9, the relevant part of Eurocode-3 for fatigue design, is not covering design and classification of cold-formed thin-walled details.

Cold-formed steel members are increasingly adopted in racking systems installed in logistic warehouses where "storage and retrieval" (S/R) machines run faster and faster, while carrying heavier and heavier loads in a "7 days - 24 hours" economy. For this reason, loading conditions on these type of racks and their auxiliary structures are not anymore quasi-static but dynamic, and cold-formed steel structural details may be subjected to load cycles in the order of 0.5 million/year. Despite many (high-cycle) fatigue failures recently occurred, the total lack of fatigue assessment rules for cold-formed steel structural details at European level represents a relevant problem for the whole European logistic industry, causing losses estimated in the order of 25-30 millions/year.

Answering to this industrial need, FASTCOLD aims at generating essential knowledge in the field of fatigue assessment of cold-formed steel structural details, with the intrinsic wider perspective of a “pre-normative” research, as the results will be presented in a way compatible for immediate implementation in Eurocodes. The project aims at developing fatigue design rules of general validity for cold-formed steel structural details and at generating a classification of such details according to their fatigue strength (like those given for thick-walled, hot-rolled steel details in EN 1993-1-9). Specific focus will be given to applications for the logistic industry (which represent a typical case of fatigue prone cold-formed structural steel details).

Coordinator	*Country*	*Scientific person in charge*
FINCON CONSULTING ITALIA SRL	IT	Prof Carlo CASTIGLIONI
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SCL INGEGNERIA STRUTTURALE DI STEFANO CALZOLARI SILVANO LACAVALLA STEFANO SESANA INGEGNERI ASSOCIATI	IT	Dr Stefano SESANA
UNIVERSITA DEGLI STUDI DI GENOVA	IT	Prof Carla GAMBARO
UNIVERSITA DI PISA	IT	Prof Walter SALVATORE
UNIVERSIDADE DO PORTO	PT	Prof Abilio JESUS
EUROPEAN RACKING FEDERATION	UK	Dr Kees TILBURGS

743504 (2017)	**STROBE** *Stronger Steels in the Built Environment*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,519,693.75	Start Date	01/07/2017
	EU Contribution	€ 911,816.25	End date	31/12/2020

Abstract

This project seeks to overcome specific obstacles to the wider use of High Strength Steels (HSS) sections (S460 to S700), both homogeneous and hybrid, in building structures through the development of:

• Less conservative ductility and toughness requirements;

• Plastic design rules for HSS continuous beams and frames;

• Design rules to ensure stability of HSS members;

• An analysis tool for determining/optimising the dynamic response of HSS floor systems;

• Comparative designs (HSS versus S355) quantifying weight, carbon and cost savings resulting from the application of the research.

Proposed amendments to Eurocode 3 will be prepared and a seminar will be held with practitioners.

Coordinator	*Country*	*Scientific person in charge*
THE STEEL CONSTRUCTION INSTITUTE LBG	UK	Mrs Nancy BADDOO
Partners		
AKTIEN-GESELLSCHAFT DER DILLINGER HÜTTENWERKE	DE	Dr Tobias LEHNERT
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HOCHTIEF ENGINEERING GMBH	DE	Prof Andre DUERR
UNIVERSIDADE DE COIMBRA	PT	Prof Luis SIMOES DA SILVA
IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	UK	Prof Leroy GARDNER

Technical Group Steel 5

Steel Factories – Smart and Human

The scope TGA5 includes:

- Analytical and measurement techniques related to steelmaking/steelprocessing (quality control), work place (human impact) and to environment (external impact)
- Instrumentation, control and automation with focus on artificial intelligence and information technologies
- Decision support systems (Big Data, data analytics, interpretation and use)
- Knowledge management systems and knowledge handling
- Cyber security of steel production processes
- Social aspects of new automation or IT systems
- Working conditions and quality of life at the work place, ergonomic methods, reduction of occupational exposure (emissions, noise, …)
- Control and protection of the environment in and around the workplace Heat treatment technology

899164	**iSlag** *Optimising slag reuse and recycling in electric steelmaking at optimum metallurgical performance through on-line characterization devices and intelligent decision support systems*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,823,365.15	Start Date	01/07/2020
	EU Contribution	€ 1,694,019.09	End date	31/12/2023

Abstract

This project aims at improving slag valorization from electric steelmaking process route through improved slag conditioning and exploration of new recycling paths, to facilitate the implementation of a real "industrial symbiosis". These targets are achieved by a novel intelligent system integrating innovative measurement devices for characterization of liquid and solid slag with modelling and simulation tools to assess the EAF and LF slags' compositions and amounts.

Different systems will be exploited on industrial sites to identify the most suitable recycling paths: on-site physical-based (LIBS and deterministic model), on-line based on electrical impedance sensor and analytical/data-driven approaches (heuristic, AI-based and hybrid). All such system will provide information on the slag features which will be exploited by decision support systems providing support to the operators and plant managers for optimal valorization of the slag inside and outside the steelmaking cycle.

Coordinator	*Country*	*Scientific person in charge*
SCUOLA SUPERIORE DI STUDI UNIVERSITARI E DI PERFEZIONAMENTO S ANNA	IT	Dr Valentina COLLA

Partners		
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SIDENOR INVESTIGACION Y DESARROLLOSA	ES	Dr Inigo UNAMUNO IRIONDO
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VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Dr Bernd KLEIMT
INSTITUT FUR BAUSTOFF-FORSCHUNG EV	DE	Mr David ALGERMISSEN
TENOVA SPA	IT	Dr Enrico MALFA
ACCIAIERIE DI CALVISANO SPA	IT	Dr Piero FRITTELLA
DEUTSCHE EDELSTAHLWERKE SPECIALTY STEEL GMBH & CO. KG	DE	Mr Jens Sebastian KLUNG

899208	**ControlInSteel** *Dissemination and valorisation of RFCS-results in the field of "Advanced Automation and Control Solutions in Downstream Steel Processes" and development of a strategic vision for future research*			
Info	Type of Project	Accompanying measures	Duration (months)	24
	Total Budget	€ 401,603.60	Start Date	01/07/2020
	EU Contribution	€ 401,603.00	End date	30/06/2022

Abstract

Disseminating RFCS project results regarding Advanced Automation and Control in Downstream Steel Processing, the proposal aims to maximize the impact of 46 research projects. After a previous dissemination project covering automation in secondary-metallurgy, a dedicated project valorising advanced control techniques throughout the solid phase is urgently needed. Dissemination will present existing project results to broad audience, including workshops on European level performed together with subcontractor ESTEP. The project evaluates used techniques, achieved impacts and the potential of transfer in a scientific way. Based on this evaluation, directions for future research will be identified and summarized in a guidance document.

Coordinator	*Country*	*Scientific person in charge*
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Dr Marcus NEUER
Partners		
SCUOLA SUPERIORE DI STUDI UNIVERSITARI E DI PERFEZIONAMENTO S ANNA	IT	Dr Valentina COLLA
RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Francesca MARCHIORI
UNIVERSIDAD POLITECNICA DE MADRID	ES	Prof Joaquin ORDIERES

899248	**InTEGrated** *Development of innovative TEG systems optimized for energy harvesting from EAF off-gas cooling water and radiative waste heat sources designed to be cost-effectively InTEGrated within steel plants*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,997,028.05	Start Date	01/07/2020
	EU Contribution	€ 1,198,216.83	End date	31/12/2023

Abstract

InTEGrated is the continuation of the THERELEXPRO project. InTEGrated research will develop innovative thermoelectric generation prototypes based on the concepts of compactness, modularity and overheating protection systems, as highlighted by the experience gained from the former project. New prototypes will be optimized for energy harvesting from EAF off-gas cooling water and high temperature radiative waste heat, designed to be integrated within new or existing plants. A dedicated finite-element "system model" will be created, able to simulate the performance of thermoelectric systems. InTEGrated will address key improvements aimed to raise the technology up to TRL 7.

Coordinator	*Country*	*Scientific person in charge*
RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Ugo CHIAROTTI
Partners		
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ERGOLINES LAB SRL	IT	Dr Isabella MAZZA
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ESF ELBE-STAHLWERKE FERALPI GMBH	DE	Dr Piero FRITTELLA

899252	**RoboInspect** *MOBILE ROBOTS FOR INSPECTION OF STEEL PLANTS*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,076,778.00	Start Date	01/07/2020
	EU Contribution	€ 1,246,066.73	End date	31/12/2023

Abstract

The objective of RoboInspect is to introduce novel robotic inspection systems in the European steel industry. For this purpose, existing technologies based on unmanned vehicles are assigned to inspection tasks and technological gaps are closed by further developments. The aims are to reduce downtimes and increase occupational safety. Unmanned aerial and ground vehicles are developed for autonomous operation during running production in confined and hazardous areas, using custom indoor navigation concepts. Software is provided to accelerate damage analysis of facilities and processes as well as to detect online plant misalignments. The developments will be tested in two industrial plants in four typical use cases.

Coordinator	*Country*	*Scientific person in charge*
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899345	**EnerMIND** *Energy Management in the Era of Industry 4.0*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	42
	Total Budget	€ 1,231,022.10	Start Date	01/07/2020
	EU Contribution	€ 615,511.05	End date	31/12/2023

Abstract

The project addresses the problem of the optimal Energy Management in steel plant through a software demonstrator characterized by a new IoT/IIoT architecture connecting two network rings to bridge the energy market and the internal energy management including utilities. The solution will make extensive use of Artificial Intelligence, Machine Learning and Optimization techniques to develop new data-driven models with evolutionary capabilities able to "learn from experience". Superior forecasting and reliable capabilities will be integrated leading to optimized planning and resource scheduling. Security will be included considering technologies like Blockchain or others to securely certify transactions of energy exchange.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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839990 (2019)	**Optimasteel** *Optimum working conditions for ageing workers in Steel industry*			
Info	Type of Project	Accompanying Measures	Duration (months)	21
	Total Budget	€ 637,746.45	Start Date	01/06/2019
	EU Contribution	€ 637,746.45	End date	28/02/2021

Abstract

OptimaSteel addresses the ergonomics problems caused by human computer interaction in a steel industry with an ageing workforce, and its impact in working conditions, health and safety and quality of life in the workplace.

Successful ageing at work and how to support and retain older workers is a critical challenge for organizations. Such issues are particularly accurate in the steel industry. Steel is an ageing industry. The median age of steel industry employees has always been higher than the all-manufacturing average, both in Europe and in the US.

OptimaSteel will address these problems by identifying, assessing, demonstrating and disseminating towards the steel industry state of the art technologies and methods to improve the quality of life of older adults in their working environment. The solution to current health, safety and wellbeing of steel workers does not rely on a single technology or on a new development, and only by combining physical, ergonomic, nutritional and cognitive aspects can a holistic approach to enhance the wellbeing and quality of life at the workplace of older adults be developed. The main goal of our project is therefore to build on state of the art solutions from top-end technology developers and research institutes across EU, to provide well-balanced and holistic systems that are able to meet the steel industry needs and offers benefits and an enhanced quality of life for older adults at the workplace.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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EUROPEAN FEDERATION FOR WELDING JOINING AND CUTTING	BE	Prof Luísa COUTINHO
PEUGEOT CITRÖEN AUTOMÓVEIS PORTUGAL, S. A.	PT	Mr Carlos MESQUITA

839227 (2019)	**REUSteel** *Dissemination of results of the European projects dealing with reuse and recycling of by-products in the steel sector*			
Info	Type of Project	Accompanying Measures	Duration (months)	24
	Total Budget	€ 518,858.05	Start Date	01/06/2019
	EU Contribution	€ 518,858.05	End date	31/05/2021

Abstract

Many research initiatives and projects funded by the RFCS have been undertaken in order to improve reuse and recycling of by-products which are produced in different stages of the integrated or electric steel production cycle (e.g. slags, sludge and scale) and for recovering valuable materials from wastes. Recently, the concept of "circular economy" is receiving increasing attention in the scientific and technical community. The circularity concept pushes researchers and industries to look for synergies with other industrial sectors to analyze and investigate solution for improving by-product re-use and recycling both inside and outside the steelmaking cycle, by thus developing examples of industrial symbiosis.

However, the joint efforts of the EU steel industries on this theme are still not widely known. Moreover, the exploitation of some research results are sometimes hampered by not homogeneous regulations in the different European countries concerning even the definition and classification of some materials as by-products or wastes.

REUSteel aims at extensively disseminating and valorizing important research results on the reuse and recycling of by-products, based on an integrated critical analysis of many list of EU-funded projects, in order to promote the results exploitation and increase the synergies with other sectors. This analysis will also aim at identifying the most urgent needing and ambitions of the EU steel sector, by defining future research topics in this field and highlighting eventual non-technical showstoppers. Common actions will be identified in order to overcome or smooth the existing obstacles and to pave the way to research and implementation of innovative solutions. The target is a wider improvement of by-products reuse and recycling, which can be developed in the future years.The key findings will be implemented in the ESTEP's Strategic Research Agenda. REUSteel will contribute to the low carbon Europe and Big-Scale initiative of EUROFER.

Coordinator	*Country*	*Scientific person in charge*
SCUOLA SUPERIORE DI STUDI UNIVERSITARI E DI PERFEZIONAMENTO S ANNA	IT	Dr Valentina COLLA

Partners		
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INSTITUT FUR BAUSTOFF-FORSCHUNG EV	DE	Mr David ALGERMISSEN
SWEREA MEFOS AB	SE	Dr Mikael LARSSON

847296 (2019)	**OMA** *Online Microstructure Analytics*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 6,296,614.85	Start Date	01/07/2019
	EU Contribution	€ 3,747,804.66	End date	31/12/2022

Abstract

To reduce CO2 emissions and energy consumption in mobility and transport, the steel industry enables weight savings by expansion of the Advanced High Strength Steel (AHSS) product portfolio. AHSS owe their strength to their largely refined and complex microstructures, containing multiple metallurgical phases. Optimal control of the thermo-mechanical processing of AHSS requires inline sensors for real-time monitoring of evolution and consistency of microstructure and material properties. This OMA proposal aims at improving the quality of the information on AHSS's microstructure and mechanical properties extracted from existing inline sensing equipment by combining the strengths of multiscale material models, model inversion techniques and advanced data analytics.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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ASOCIACION CENTRO TECNOLOGICO CEIT-IK4	ES	Ms Ane MARTINEZ DE GUERENU
THE UNIVERSITY OF WARWICK	UK	Prof Claire DAVIS
THE UNIVERSITY OF MANCHESTER	UK	Prof Anthony PEYTON
NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO	NL	Mr Quincy MARTINA
SWEREA MEFOS AB	SE	Dr Mikael MALMSTRÖM
SCUOLA SUPERIORE DI STUDI UNIVERSITARI E DI PERFEZIONAMENTO SANT'ANNA	IT	Dr Valentina COLLA
COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	FR	Dr Christophe REBOUD
ECOLE NORMALE SUPERIEURE DE CACHAN	FR	Prof Olivier HUBERT
ALTAIR ENGINEERING FRANCE	FR	Mr Patrick LOMBARD
UNIVERSITE GRENOBLE ALPES	FR	Prof Stéphane LABBÉ

847249 (2019)	**E-CO-LadleBrick** *Ecological and Economical waste management of the ladle refractory bricks by implementing circular economy criteria*			
Info	Type of Project	Research	Duration (months)	36
	Total Budget	€ 1,280,225.60	Start Date	01/06/2019
	EU Contribution	€ 768,135.36	End date	31/05/2022

Abstract

Ladle refractory material waste in the European Steelworks is currently mostly being dumped in landfills. This Circular Economy Project answers to this situation based on a 4 R´s model, combining a Reduction of the waste by means of monitoring and optimizing the ladle refractory consumption (via remaining brick thickness) with processes for Reusing/Remanufacturing and Recycling the ladle refractory brick wastes. The final optimized application will come from an expert decision tree and accompanied by the corresponding LCA studies. This innovative approach and knowledge would be totally transferable to other steel companies with both significant environmental and economic benefits.

The main aims of the "E-CO-LadleBrick" project are the following:

• To achieve an innovative ecological and economical waste management for the worn ladle bricks by implementing Circular Economy criteria based in environmental 4R model (Reduce, Reuse, Remanufacture and Recycle).

• To optimize remaining final thickness for the bricks used as ladle refractory (Reduce) by means of developing a 3D laser scanner technique (aiming to high accuracy measures, deviations under 10 mm), together with machine learning models and regression analysis. This approach can be replicated and implemented in any other Steel Plant.

• To optimize the valorisation of the worn bricks after their use as ladle refractory (Reuse, Remanufacture and Recycle) by means of finding suitable applications as well as their benefits and restrictions and implementing a data-based decisión mechanism for best valorisation in either Reuse, Remanufacture or Recycle. This approach can be replicated and implemented in any other Steel Plant.

Coordinator	*Country*	*Scientific person in charge*
SIDENOR INVESTIGACION Y DESARROLLOSA	ES	Mr David MAZA

Partners		
FUNDACION TECNALIA RESEARCH & INNOVATION	ES	Mr Abel CAPELASTEGUI
FORSCHUNGSGEMEINSCHAFT FEUERFEST EV	DE	Mr Christian DANNERT
2.-O LCA CONSULTANTS APS	DK	Dr Ivan MÕNOZ

847203 (2019)	**DynReAct** *Refinement of production scheduling through dynamic product routing, considering real-time plant monitoring and optimal reaction strategies*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,275,448.50	Start Date	01/06/2019
	EU Contribution	€ 765,269.10	End date	30/11/2022

Abstract

Aim of this project is to improve flexibility of production scheduling in flat steel production by generation of optimized production plans for each individual coil at each production step considering real-time plant information. This concept enables immediate reactions to critical situations like insufficient plant performances or off-spec coils. The optimal routings will be estimated using real-time capable plant performance models derived from machine learning on large historical data, which will be incorporated in multi-objective, stochastic optimization methods.

The applicability of the system will be demonstrated at tin-plate production providing multiple production steps with free choice of multiple plants.

Coordinator	*Country*	*Scientific person in charge*
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UNIVERSIDAD POLITECNICA DE MADRID	ES	Prof Ordieres JOAQUIN

847202 (2019)	**AutoSurveillance** *Automatic surveillance of hot rolling area against intentional attacks and faults*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,589,524.25	Start Date	01/06/2019
	EU Contribution	€ 953,714.55	End date	30/11/2022

Abstract

Is a hot rolling mill secured against intentional attacks? Could a re-heating furnace or the accelerated cooling be used for sabotaging the quality of a European steel producer? How can attacks be separated from fault behaviour? AutoSurveillance will provide a solution for detecting anomalies in re-heating furnaces, hot-rolling mills and accelerated cooling, a solution that is capable of announcing a threat and in parallel distinguishing between faults and intentional attacks. It focusses on the process-oriented treatment of such occurrences and explicitly not on the IT perspective. The project consortium of AutoSurveillance concluded that there is urgent need to increase the security of control system in European steel plants from an inner process perspective and not to trust in the security an outer IT environment can offer. Therefore any successful novel kind of detection, healing and resilient strategy must be founded on the process knowledge itself. Although the occurrence of such events is actually rather low, the economic stakes of such an event are unbearable high for the European steel industry: the consequences are production out-times, damaged machinery and repair activities, all of which

eat up man-hours and money in an excessive way. It hardens the automation system against it on process level. Many other effects can obfuscate or obscure the view on the process, such as sensor and actuator uncertainties and process anomalies. To detect intentional sabotage, one must prior exclude things like drifts or errors in the measurements and unintentional process anomalies caused by the instability of process situations. Hence there is a need for monitoring control systems online, to detect any kind of abnormal behaviour. Sensorial deficiencies, actuator malfunctioning or process perturbations must be elemental part of a system that secures against intentional damages!

Coordinator	*Country*	*Scientific person in charge*
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UNIVERSIDAD POLITECNICA DE MADRID	ES	Prof Joaquin ORDIERES
SIDENOR INVESTIGACION Y DESARROLLOSA	ES	Mr Asier ARTEAGA

800677 (2018)	**NEWTECH4STEEEL** *Enhanced process stability and product quality in steel production by exploitation of break-through technologies for real-time monitoring, control and forecasting inspired by Big Data concepts*

Info				
	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,405,313.75	Start Date	01/06/2018
	EU Contribution	€ 1,443,188.25	End date	30/11/2021

Abstract

The constantly growing requirements to European steel production concerning product quality and process efficiency are accompanied by massive increases of data and information collection at the processes and about the products.

So, there is the possibility, but also the need for new methods to observe and control production processes and to determine and to forecast the properties of intermediate and final products. These new technologies have to exploit comprehensively those huge information sources collected at the steel plants.

This project will focus on dedicated use cases in steel industry, which are related to actual problems and tasks in modern steel production.

The consortium will develop and implement methodologies, which will meet the requirements of examined steel processes on the one hand, but also exploit all technological and scientific possibilities offered by latest technologies concerning data handling and data analysis on the other hand.

To reflect the variety in steel production, the selected industrial use cases cover different processing routes and various final products like flat steel, tube and wire production. Thereby the project findings will be applied and tested under industrial conditions to adjust them to the needs of the European steel industry. The participating non-steel partners like research organisations and suppliers for steel industry guarantee the exploitation of latest available methodologies and technologies.

The final aims of this proposed project are:

- the developed and applied methods for an improved process observation and control as well as extended tools to assess and forecast (intermediate) product quality as examples for the successful application of new technologies,

- to provide evidence of the applicability and efficiency of such methods,

- to make proposals and uncover possibilities of developed new methods outside the investigated use cases to state their benefits for the complete European steel sector.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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ACCIAIERIE E FERRIERE DI PIOMBINO SPA	IT	Mrs Alessandra MERIGO
IBA AG	DE	Dr Andreas QUICK
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RINA CONSULTING - CENTRO SVILUPPO MATERIALI SPA	IT	Dr Luca PIEDIMONTE
MARCEGAGLIA CARBON STEEL SPA	IT	Dr Alessandro FERRAIUOLO
DANIELI AUTOMATION SPA	IT	Mr Andrea POLO

800657 (2018)	**CYBERMAN4.0** *Cyber Physical System-based approach for intelligent data-driven maintenance operations applied to the rolling area*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 2,658,641.15	Start Date	01/09/2018
	EU Contribution	€ 1,595,184.69	End date	28/02/2022

Abstract

Cyberman4.0 aims at turning maintenance strategy in steel industry from preventive to optimized predictive maintenance by experimental systems and tools built upon the Industry 4.0 enabling technologies proposing the Integrated Maintenance Model 4.0 (IMM4.0) applied into the rolling area. Investigations on new methods and experimental tools will validate approach and expected benefits like flexibility, machine uptime and costs. Four use cases will be developed considering flat products, an innovative rolling mill for long products the hot and cold rolling roll shop management for flat products connecting product quality and machine status as a valuable indicator of health awareness.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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TENOVA SPA	IT	Mr Claudio TREVISAN
VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH	DE	Mr Fabien NKWITCHOUA
ARCELORMITTAL RUHRORT GMBH	DE	Mr Claude MARX

793505 (2018)	**WISEST** *4.0 Lean System integrating workers and processes*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,387,284.00	Start Date	01/09/2018
	EU Contribution	€ 832,370.64	End date	28/02/2022

Abstract

The project idea is to develop advanced tools to automatically collect information from workers and processes, integrate this Information correlating both data sets time wise and event wise and finally produce an assessment of the whole system and offer recommendations for improvement. The recommendations will aim to improve working conditions, safety, knowledge preservation and training (for the workers area) and improve quality and lead to lean operation & maintenance (for the whole system composed of workers and industrial processes). The specific purpose is to integrate I4.0 and people in different Steel processes (like scrap management, steel production, final product preparation and dispatching, coil cutting in automotive industry, etc) in order to promote the application of Lean culture principles in steel industry in combination with IIoT and I4.0. Factors like energy consumption, safety, environmental and workers' health parameters at work place will be considered as KPI's associated to the lean oriented assessment of every process. Working topics are:

●Collection of information about workers position and health parameters (using wearable devices).

●Collection of event oriented information from the processes (using PLCs signals and IIoT).

●Integration of workers' information within processes status to assess the whole process.

●Consideration of all the factors, including safety & health in processes lean performance.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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GESCRAP HUNGARY KORLATOLT FELELOSSEGU TARSASAG	HU	Mrs Jaroslava VLADYKOVA
GESTAMP LOUNY S.R.O	CZ	Mr Jaime CAMPO
ACEROS PARA LA CONSTRUCCIÓN S.A.	ES	Mrs Anna CASALS

788552 (2018)	**QUALITY4.0** *Transparent product quality supervision in the age of Industry 4.0*			
Info	Type of Project	Research	Duration (months)	42
	Total Budget	€ 1,201,417.90	Start Date	01/06/2018
	EU Contribution	€ 720,850.74	End date	30/11/2021

Abstract

In a world where steel products can be acquired through platforms like Alibaba.com and the steel market is flooded with cheap steel from Chinese overcapacity, European Steel producers urgently need differentiation as distance or referencing are not a protection anymore.

From steel customers' point of view, one main reason for the decision for a specific supplier is trust in the fact that the delivered product fulfills his individual requirements. Consequently only if the European Steel Industry succeeds to win customer-trust and solidifies client intimacy, it will achieve a durable competitive advantage and thus reduce pressure from world-wide imports

Consequently, this project aims to establish a new level of customer-supplier collaboration by means of the horizontal integration of quality information over the complete supply chain comprising the full exploitation of all available quality information and knowledge from the measurement up to the final product at downstream industries (e.g. car manufacturer).

In this project an adaptive Quality4.0 platform will be developed which allows online analytics of large data streams to realise decisions on product quality and provide tailored information of high reliability that can be individually exchanged with customers to put a common focus on the manufacturing of highest quality goods.

A bidirectional customer/supplier exchange of quality relevant information is foreseen, enabling lower production costs, increased yield and improved identification of quality problems in steel production processes.

In times of challenging global markets with very strong competition from outside Europe it is of strategic importance for the European steel industry to proactively promote such a common platform instead of reacting on specific customer demands.

Coordinator	*Country*	*Scientific person in charge*
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753592 (2017)	**TRACKOPT** *Consistent ladle tracking for optimisation of steel plant logistics and product quality*			
Info	Type of Project	Pilot&Demonstration	Duration (months)	42
	Total Budget	€ 898,257.65	Start Date	01/01/2018
	EU Contribution	€ 449,128.82	End date	30/06/2021

Abstract

The project will implement automated ladle tracking systems to ensure consistent factory-wide tracking of the product from steelmaking via casting to delivery. The wireless tracking system in harsh steelworks environment will provide mandatory input data for projects on digitalisation ("Industry 4.0"). Automated, reliable information on actual position of ladles result in increased factory output (avoided hold-ups or downgrading of products due to mix-up of ladles) and in improved safety in steelworks. Furthermore the ladle tracking system will be used to optimise ladle logistics during both smooth production conditions and in case of sudden disturbances in production plan.

Coordinator	*Country*	*Scientific person in charge*
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748878 (2017)	**DISSI2M** *Dissemination of results of RFCS-projects in the field of Integrated Intelligent Manufacturing and public discussion of a roadmap in this field*			
Info	Type of Project	Accompanying Measures	Duration (months)	24
	Total Budget	€ 407,220.85	Start Date	01/07/2017
	EU Contribution	€ 407,220.85	End date	30/06/2019

Abstract

In the year 2004 the first Strategic Research Agenda (SRA) of ESTEP (=European Steel Technology Platform) has been written as common action of the European Steel Industry. The topic of "Integrated Intelligent Manufacturing" (I2M) was from the very beginning part of this SRA. A working group has been founded in the year 2007 and has started to create common RFCS proposals. In the meantime this technological field is in Europe better known under the topic of "Industry 4.0". The aim of this proposal is now to disseminate the results of all RFCS projects to this topic, to start a public consultation process about a just finished I2M-roadmap and to create a sequence of future research topics in the field.

Coordinator	*Country*	*Scientific person in charge*
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EP-PP-CLEAN-STEEL-2019

Research on reduction of CO_2 emissions in steel production

European Parliament Pilot Project - Research on reduction of CO_2 emissions in steel production[1]

(2020) 882151	**GREENSTEEL** *Green Steel For Europe*			
Info	Type of Project	Accompanying Measure	Duration (months)	18
	Total Budget	€ 1,247,612.45	Start Date	01/01/2020
	EU Contribution	€ 1,247,612.45	End date	30/06/2021

Abstract

"Green Steel for Europe" supports the EU towards achieving the 2030 climate and energy targets and the 2050 long-term strategy for a climate neutral Europe, with effective solutions for clean steelmaking. Totalling 10 partners (including a think tank, research and technology organisations, a European industrial association and a European technology platform), the project consortium relies on the best mix of skills and expertise and allows for full coverage of the EU Member States and steelmaking installations.

"Green Steel for Europe" will achieve its objectives thanks to the combined efforts of the consortium partners in four areas: (i) developing a technology roadmap and defining midand long-term pathways for the decarbonisation of the EU steel industry; (ii) identifying public and private funding opportunities and proposing blending and sequencing options to maximise their impacts; (iii) assessing the economic, social, environmental and industrial leadership impacts of EU-level policy options; and (iv) ensuring the dissemination of the project results and engagement of relevant EU stakeholders. Through its innovative approach consisting of the combined assessment of promising technologies, industrial transformation scenarios, and policy options and impacts, "Green Steel for Europe" will effectively contribute to the sustainable decarbonisation of the steel industry. Ultimately, the project will help position the EU as a leading provider of low-carbon products, services and advanced technologies in steelmaking, and support the green transition and fight against climate change on a global scale.

Coordinator	*Country*	*Scientific person in charge*
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Partners		
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[1] C(2019)3019, available online:
https://ec.europa.eu/transparency/regdoc/?fuseaction=list&coteId=3&year=2019&number=3019&version=ALL&language=en

ANNEX I: NEW STRUCTURE TECHNICAL GROUPS (effective since 14/06/2019)

'Following the advices of CAG and SAG and endorsement of COSCO in 2018, the Commission has decided to reduce the number of the Technical Groups from 12 to 7 with 2 for Coal (instead of 3) and 5 for Steel (instead of 9). This contributes to make the management of the RFCS programme more efficient, to update the coal and steel themes, and to give more coherence to the portfolio of RFCS coal and steel projects. The New Technical Groups are the following: 2 TGK for Coal and 5 TGA for Steel.'[1]

GENERAL NEW-OLD TG CORRESPONDENCE

New TGs	Old TGs
TGK1- POST-MINING ISSUES, SAFE AND PRODUCTIVE COAL MINING OPERATIONS	TGC1
TGK2 - ENVIRONMENTAL, TECHNICAL AND ECONOMIC ISSUES RELATED TO COAL TREATMENT AND USE	TGC2 TGC3
TGA1 - IRON AND STEELMAKING	TGS1 TGS2
TGA2 - DOWNSTREAM STEEL PROCESSING	TGS3 TGS4
TGA3 - CONCEPTION OF STEEL PRODUCTS	TGS5 TGS6
TGA4 - STEEL APPLICATIONS AND SOLUTIONS FOR EXISTING AND NEW MARKETS	TGS7 TGS8
TGA5 - STEEL FACTORIES - SMART AND HUMAN	TGS9

EXCEPTIONAL TRANSFERT OF PROJECTS

Because of the changes in the scientific scope[2] of each TG, in 2019 the following projects have been transferred to a different TG.

PROJECT acronym and name	**TG TRANSFERT**
RFCS-2017-800769 - HighSpeedGalvanizing	Transferred from TGA3 to TGA2
RFCS-2018-847318 – CleanEX	Transferred from TGA3 to TGA2
RFCS-2018-847341 – CentriClean	Transferred from TGA3 to TGA2
847260 (2019) – Slagreus	Transferred from TGS9 to TGA1
800762 (2018) – Ecoslag	Transferred from TGS9 to TGA1
800654 (2018) – Wham	Transferred from TGS9 to TGA1

[1] Extract from the *RFCS Information package 2019,* 14 June 2019

[2] See link *supra*.