Nr	Number of contract	Title	Acronym	Report number	Participants	Start date	End date	Abstract
1	7210-CB/107	Development of process technology and metallurgy for extremely low and strictly limited nitrogen contents	/	EUR 14483 DE	BFI	1989-01-01	1990-12-31	To satisfy requirements for steel with low nitrogen contents and steels with very precise nitrogen contents, fundamental data on denitrogenation in liquid steelmaking were applied to develop a thermodynamic and kinetic model.
2	7215-CA/107	On-line analysis of molten steel for automated steel production (1st phase)	/	EUR 15184	TK Nirosta, ARBED, KRUPP Elektronik, Krupp Forschung, Univ. Madrid	1989-04-01	1991-03-31	The objective of this pilot project was to build and test an on-line analysis system for monitoring and measuring the change in concentration of various elements in liquid steel by laser-induced spectroscopy. The measurement system was tested for monitoring the carbon content in an AOD converter.
3	7210-CC/104	Development of a model for the vacuum circulating process	/	EUR 16186 DE	BFI	1990-08-01	1994-01-31	The objective of this project was to develop a detailed dynamic model for decarburisa-tion in the RH process, which can be used for on-line monitoring of the process behaviour.
4	7210-GD/109	Fast multi-element on-line analysis of steel melts by means of laser technology - Development of a novel method for laser emission spectrometry (Phase I)	/	EUR 16632	Inst. Siderugie Francais, Fraunhofer, TKSE	1991-12-01	1993-11-30	This project intended to develop the use of a modulated laser to excite specific emission peaks for certain elements over wavelengths compatible with the use of optical fibres. The results were to be used to develop a rapid system for analysing liquid steel bath composition.
5	7210-GD/409	Direct trace element analysis by AES with a high energy source (Phase II)	/	EUR 16702 IT	CSM	1991-07-01	1993-12-31	This project intended to continue previous development work and produce an AES source for increased accuracy and sensitivity of element analysis in liquid steel of at least an order of magnitude compared with classic analytical techniques.

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6	7210-CC/805	Optical sensing of temperature and stirring conditions in ladle furnaces	/	EUR 18365 EN	British Steel	1992-07-01	1995-06-30	The aim of this project was to develop new techniques for the measurement of stirring, inclusion entrainment and steel temperature in a ladle furnace and to exploit these techniques with the aim of balancing demands for fast working with steel cleanness and energy efficiency.
7	7215-EB/10	Continuous measurement and analysis of liquid steel (BOF)	/	/	DH, CRM, Inst. Siderugie Francais, Klöckner Stahl	1993-07-01	1996-06-30	Within this project a device was installed at a BOF converter, which is capable of continuously measuring temperature using pyrometry techniques as well as analysing the carbon and phosphorus contents of the liquid metal. Excitation will be based on laser beam techniques.
8	7210-CC/109,110,701	Process Modelling, Process Measurements and Control to Optimise Secondary Steeelmaking in the Production of Super Clean Steels	/	/	GMH, British Steel, RWTH, BFI, Sidenor, CSM, Uni Patras, VDEh	1993-07-01	1996-12-31	This project improved the performance of secondary steelmaking vessels by developing techniques of process modelling, measurement and control of slag, vacuum and temperature parameters. Bubbling and vacuum techniques were employed for production of super-clean steels.
9	7210-CB/122,312,941	Low Nitrogen in EAF steelmaking	/	EUR 19349 EN	Inst. Siderugie Francais, ACENOR, RWTH	1995-07-01	1998-12-31	The low nitrogen content required for highly ductile steel grades (strips, bars, wire) is not usually achieved in conventional, 100% scrap-based EAF steelmaking. The aim of the research was to establish the feasibility and the features of an industrial process for producing low nitrogen (50 ppm and less) steels in the EAF, using scrap as iron source.
10	7210-MA/319, 320	High nitrogen stainless steels by AOD / VOD process	/	EUR 19417	IRSID, Creusot-Loire Industrie	1995-07-01	1998-12-31	Within this project, the thermodynamics of nitrogen alloying in stainless steelmaking by bottom stirring during ladle treatment under atmospheric pressure were investigated, and a model for description of the nitrogen behaviour was developed.

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11	7210-CC/116,407,117	Improvement of vacuum circulation plant operation on the basis of the BFI simulation model	/	EUR 19488 EN	BFI, Voest Alpine, CSM	1995-07-01	1999-06-30	Within this project a simulation model of the vacuum circulation process (RH) for decarburization of steel was extended to include further metallurgical operations such as stirring, gas input, oxygen blowing, dehydrogenation and nitrogen control and to improve process control of RH plants.
12	7210-CC/121/122/936	Dynamic modelling and control of the vacuum degassing process	/	EUR 19484 EN	Buderus, Sidenor, BFI	1996-07-01	1999-06-30	Within this project a process control system for vacuum treatment in ladle degassing stations or similar facilities was developed. By means of dynamic process models for decarburization, desulphurisation, denitrogenation and dehydrogenation, the vacuum treatment time was predicted.
13	7210-CC/114	Improvement of cleanness and fine-grain structure of Ca-treated and Al-deoxidised steels with a high S content made by continuous casting of billets and blooms	/	EUR 19486	TU Bergakademie	1995-07-01	1999-06-30	In this research project the process routes: - EAF-LFV; - LD-RH-degassing, were optimized for production of Al-deoxidized steel grades with S- contents. Ladle metallurgy and process engineering were investigated for the production of these critical steels with high cleanness requirements.
14	7210-GD/120	Sensitivity enhanced laser analysis of steel melts for fast multi-element on-line analysis during ladle processing in secondary metallurgy	SELA	EUR 19411	Fraunhofer, RWTH, RAUTAUUKKI, TKSE	1996-07-01	1998-06-30	The goal of this research project was the performance evaluation of fast multi-element, on-line laser analysis during ladle processing in steel metallurgy with determination limits of less than 10 ppm, especially for carbon, phosphorus, sulphur and nitrogen.
15	7210/CC/302/303/809	Development of techniques to minimise ladle/slag interaction and prevent uncontrolled inclusion modification	/	EUR 19485	IRSID, British Steel, SOLLAC	1996-07-01	1999-06-30	The main goals of this project were to identify detailed mechanisms of mass transfer from refractory lining of ladles towards steel regarding carbon pick-up by ultra-low carbon steels and contamination by glazed ladle lining from previous casts, to improve process practices in ladle that minimise both aspects and thus to contribute to a better control of steel inclusion populations and of steel composition.

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16	7210-PR/009	Control of inclusions in RH degassing processes	/	EUR 20179	IRSID, Corus UK, CRM, BFI	1997-07-01	2000-12-31	The main aim of this project was to develop, test and validate physical and CFD modelling techniques for the evaluation of RH vacuum degasser performance with respect to steel cleanness.
17	7210-PR/011	Dynamic process control of AOD converter	/	EUR 20177	CSM, AST, KTN, BFI	1997-07-01	2000-12-31	A dynamic model for decarburisation and temperature behaviour within the AOD process was developed, based on balance calculations for carbon, oxygen and energy and used off-gas analysis and flow rate values to determine the decarburisation rate and the current carbon content.
18	7210-PR/010	The use of artificial intelligence to control secondary steelmaking practices	/	EUR 28178	British Steel, CSM, Krupp, BFI	1997-07-01	2000-12-31	The objective of this project was to develop tools and techniques based on artificial intelligence to monitor the performance of heat treatment and to calculate alloy material requirements throughout the complete secondary steelmaking route.
19	7210-PR/207	Operation and control of vacuum circulation (RH) process with lance oxygen input	/	EUR 21435	BFI, voestalpine, Sollac Fos, Technometal	1997-07-01	2000-12-31	The objective of this project was to develop dynamic models for decarburisation and steel temperature behaviour within the RH degassing process with oxygen top lance, and to use these models for on-line observation and control of the lance oxygen input.
20	7210-PR-080	Desulphurisation of liquid steel with refining top slags	/	EUR 20474	Voest, CSM, DH, BFI	1997-07-01	2000-12-31	The objective of this project was to investigate the influencing parameters of the desulphurisation reaction via the ladle top slag in detail, and to optimise the process with respect to slag control and refining kinetics.

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21	7210-PR/079	Control of inclusion, slag foaming and temperature in vacuum degassing	/	EUR 20562	MEFOS, ACCIAERIE, OVAKO Sidenor, BFI	1998-07-01	2001-06-30	The objective was to develop a new concept for on-line control of the vacuum degassing process. The concepts were based on techniques as the modified OES method, radio-wave interferometry technology for slag level measurements and temperature measurements by thermovision camera.
22	7210-PR/135	Production of EAF steels with low contents in N2 and S through vacuum treatment	/	EUR 20945 EN	Sidenor, ProfilARBED, IRSID, MEFOS, BFI	1999-07-01	2002-06-30	Development of dynamic models for denitrogenation and desulphurisation in vacuum degassing for production of low-alloyed steels via the electric steelmaking route.
23	7210-PR/136	Characterisation and optimisation of ladle stirring systems for the steelmaking industry	/	EUR 20946 EN	voestalpine, TKS, Sidenor, DIFK, BFI	1999-07-01	2002-06-30	The project's aim was to improve the reliability and efficiency of the ladle stirring process. Different stirring systems were investigated with regard to their reliability, efficiency and wear.
24	7210-PR-168	Improved production control through rapid characterisation of non-metallic inclusions in steel	/	EUR 21627 EN	TKSE, Boehler, EKO, Fraunhofer, Inst. Siderugie Francais	1999-07-01	2002-06-30	Aim of the project was to develop a fast and robust laser- method characterising inclusions over a large area or volume that can be integrated into the process control.
25	7210-PR/138	Chromium-free alternative refractory for the lining of RH/DH vessels	/	EUR 21335	Arcelor, Corus NL	1999-09-01	2002-08-31	The goal of this project was to find solutions to avoid the dumping of RH refractory wastes in special costly landfills by substituting magchrome bricks by chromium-free materials among the magnesia-spinel group.

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26	7210/PR/206	The Determination and elimination of the effect of Anti-Oxidants in Magnesia-Carbon bricks on steel composition and inclusion formation	/	EUR 21446 EN	Corus UK, CSM, DIFK, Saarstahl	2000-07-01	2003-12-31	This project investigated the effects of anti-oxidant materials in MgO-C bricks on steel clearness and ladle life. A rapid analysis technique, using Laser Induced Breakdown Spectroscopy (LIBS), to detect trace elements and inclusions was also developed. LIBS was successful in mapping element distributions in refractory, slag and metal. Inclusion detection is compared with SEM methods and advantages of LIBS in speed of analysis are defined.
27	7210-RP-204	Innovative continuous on-line determination of the steel melt temperature by direct optical measurement in the melt	/	EUR 21428 EN	ACERALIA, CRM, BFI	2000-07-01	2003-12-31	In this project a new method for a continuous temperature measurement of liquid steel by pyrometer with optical fibre measurement technology was developed. The new system was tested and optimised on several steel plants including EAF furnaces, BOF converters, ladles and tundishes.
28	7210-PR-270	Improvement of inclusion flotation during RH treatment	/	EUR 22388 EN	Inst. Siderugie Francais, CSM, RWTH, BFI	2001-07-01	2004-06-30	The objective of this project was to develop a validated model of prediction of the evolution of the inclusion population during RH treatment, to evaluate the effect of ladle slag composition on the capture of inclusions and finally to propose an optimised flotation process at the RH unit.
29	7210-PR-271	In situ, quick sensing system for measurements of process-critical components in steelmaking slags	INQUISS	EUR 22818	Aceralia, Acerinox, Helliniki, Inst. De Soldadura e Qualidade, Unv. Malaga, Univ. Patras, RWTH	2001-07-01	2004-06-30	The aim of this project was the adaptation and optimisation of laser-based sensing (LIBS) in plant processing conditions, to develop a quick/on-line, in-situ measurement system of process-critical components of molten slags. Different metallurgical slags in steelmaking (EAF, Converter and Ladle) were used, and the determination oxides was achieved by detection of their elemental concentration.
30	7210-PR/300	In-line assessment of steel cleanness during the secondary steelmaking process	/	EUR 22032 EN	AM Reserach, CREAS, CRM, Sidenor	2001-07-01	2004-06-30	The aim of this project was to work out an appropriate steel cleanness index, to be used for in-line quality assessment during secondary steelmaking process. Another objective was to complete the information obtained in this way with a more precise knowledge of the inclusion size and distribution using statistical/stereological tools and distribution models. This ladle treatment in-line control was based on the fast and simultaneous determination of the steel and slag chemistry.

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31	7210-PR/269	Improvement of process control and refractory performance of the AOD converter	/	EUR 21974	Terni, CSM, TK Nirosta, BFI	2001-07-01	2004-06-30	This project was the continuation of work performed within the previous ECSC project 7210-PR/011. To improve the accuracy in on-line observation of the carbon content, a thermodynamic decarburisation model was developed. Furthermore the process observation system was extended by a thermodynamic model for the nitrogen content. On the basis of this model, a control concept for the nitrogen inert gas supply was developed, to adjust the aim nitrogen content under minimum costs.
32	7210-PR/329	De-oxidation practice and slag ability to trap non-metallic inclusions and their influence on the castability and steel cleanliness	/	EUR 23194 EN	ACERALIA, CSM, RWTH, Sidenor, Inst. Siderugie Francais	2002-07-01	2005-06-30	The aim of this research was to evaluate the inclusion properties and final steel cleanness regarding deoxidation practice and the slag ability to trap non-metallic inclusions.
33	7210-PR/330	Development of advanced methods for control of the ladle stirring process	/	EUR 22988 EN	ACERALIA, MEFOS, Saarstahl, Sidenor, BFI	2002-07-01	2005-06-30	Development of innovative methods for continuous on-line monitoring of ladle stirring processes by means of digital image analysis applied to melt surface, and by means of vibration measurements
34	7210-PR/331	Improved control of inclusion chemistry and steel cleanness in the ladle furnace	/	EUR 23593	MEFOS, CORUS, CSM, UDDEHOLM, BFI	2002-07-01	2005-06-30	The objective of the project was to enhance the control of inclusion chemistry and steel cleanness in the ladle furnace, regarding the process operation practice with respect to stirring patterns and slag practice.
35	7210-PR-332	Optimisation and evaluation of different secondary metallurgy routes to achieve high quality strip steel	/	EUR 23888	Voest, Corus, TKSE, HKM, BFI	2002-07-01	2005-06-30	The proposed research project aims at the optimisation and evaluation of different production lines to achieve high quality steel grades for strip production. The possibilities of Ca treatment in the production of these steel grades were clarified. Several secondary metallurgy lines were considered and practices for an optimised treatment by ladle furnace, RH degassing and tank degassing combinations in-line with vertical-bending slab casters and thin slab casters were worked out.

Nr	Number of contract	Title	Acronym	Report number	Participants	Start date	End date	Abstract
36	RFSR-CT-2003-00008	Investigations and measures to reduce emissions and energy consumption during preheating of steel ladles	IMSTEELLAD	EUR 23175 EN	Terni, CSM, Gerdau, TK Nirosta, BFI	2003-09-01	2006-12-31	The goal of this research project was to optimise the ladle preheating procedure for emissions and energy consumption. For that purpose also a ladle temperature control model was developed.
37	RFSR-CT-2003-00016	Cost efficient metallurgy for the production of novel ultra high strength deep drawable steel grades with high Mn contents from 10 to 25 wt.-%	PROMS	EUR 22991 EN	SZFG, Mefos, TU Clausthal	2003-09-01	2006-12-31	The aim of the project was the selection and development of suitable technologies of primary and secondary metallurgy for the production of ultra-high strength deep-drawable steels with high manganese contents these steels with an emphasis on the BOF route.
38	RFSR-CT-2003-00043	Feasibility of a fast vacuum slag analysis by laser OES in secondary steelmaking	AVAS	/	DH, AM Maizieres, Fraunhofer, Saarstahl	2003-09-01	2006-08-31	The feasibility of a fast slag analysis at the vacuum degasser for better production control in secondary steelmaking was demonstrated with the emphasis on SiO2, CaO and Al2O3. The comparability with XRF measurements (directly on casted slags and/or after preparation) was investigated by performing a round robin trial within the partners.
39	RFSP-CT-2004-00006	Application of direct optical temperature measurement in steelmaking process	DOT Application	EUR 23736 EN	DH, BFI	2004-07-01	2007-06-30	In this P&D project the temperature evolution in the BOF converter during oxygen blowing was continuously monitored to improve end point control. Therefore a measurement system was developed using an optical fibre which is continuously fed into the melt.
40	RFSR-CT-2005-00013	Innovative tundish management for final steel thermal and chemical adjustment	TUNDJUST	EUR 24348 EN	CSM, BFI	2005-07-01	2008-06-30	Alloying techniques were defined and applied via CaSi/FeS wire injection; inclusion engineering was performed via material poured into a pad. For temperature control, local reheating was successfully achieved with exothermic powders at the surface above the exits; a model for online control of steel temperature was set up and validated with plant data for operational purposes. The innovative character of the work consisted of the application in a 'continuous' reactor (tundish) of metallurgy operations typically exploited in a ladle ('batch' reactor). The application leads to cost savings allowing further steel composition/temperature control after ladle treatment.

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41	RFSR-CT-2005-00005	Improvement of purging plugs performances by investigations on the materials, process analysis and continuous monitoring	ImPurgingAr	EUR 24987 EN	CSM, Terni, Calderys Italia, BFI	2005-07-01	2009-06-30	The objective of this research project was the improvement of the purging plugs performance for ladle Ar stirring. The objective is to improve the plugs selection and management in order to enhance their performances. Overall result was to set up a model of general application of the correlations between the process and the behaviour of the plugs.
42	RFSR-CT-2005-00006	Prediction of inclusions in the slabs from the process characteristics	PREDINC	EUR 24992 EN	AME, ILVA, Politecnio Milano, RWTH, Scuola Superiore Sant´Anna, Aalto, U. Oviedo	2005-07-01	2008-12-31	The aim of this project was to develop a system capable to determine the quality in the field of inclusions of steel before and during its production, in order to change the setups to improve it. Two ways of model development were carried out: classical thermodynamic calculation and data-based analysis.
43	RFSR-CT-2006-00018	Grain size control in steel by means of dispersed non-metallic inclusions	GRAINCONT	EUR 24993 EN	KTH, AM Maizieres, Comdicast, CRM, Aalto U.	2006-07-01	2009-06-30	Within this project research work was carried out to control steel composition and temperature in the tundish, and to perform inclusion engineering. The research work was supported by fluid dynamics management, aimed at favouring dissolution of materials for alloying and inclusion modification, and at allowing the identification of injection techniques. A model for online control of steel temperature was set up and validated with plant data for operational purposes.
44	RFSR-CT-2006-00005	Cost efficient metallurgy for the production of novel ultra high strength deep drawable steel grades with high Mn contents from 10 to 25 wt.-% by using EAF steel making route	EAF-PROMS	EUR 24225 EN	SZFG, Mefos, TU Clausthal	2006-09-01	2008-12-31	The aim of the work was the selection and development of suitable technologies of primary and secondary metallurgy for the production of ultra high-strength deep-drawable steels with high manganese contents with emphasis on the EAF route.
45	RFSR-CT-2007-00004	Online control of desulphurization and degassing through ladle bubbling under vacuum	ONDECO	EUR 25091 EN	AM Maizieres, DH, Voestalpine	2007-07-01	2010-06-30	Development of image and vibration sensors to qualify the stirring state during LF treatment and VD degassing and use it as input for a desulphurisation model

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46	RFSR-CT-2007-00009	Improvement of ladle stirring to minimise slag emulsification and reoxidation during alloying and rinsing	STIMPROVE	EUR 25068 EN	KTH, Saarstahl, Aalto Univ. BFI	2007-07-01	2010-06-30	Development of digital infrared image analysis and theoretical models to assess stirring process parameters and clarify their interaction with steel metallurgy
47	RFSR-CT-2007-00011	Development of steel grade related slag systems with low reoxidation potential in ladle and optimised ladle glaze technique for improving steel cleanness	STEEL-CLEAN-CONTROL	EUR 25076 EN	TU Freiberg, KTH, SSAB, TK Nirosta, Uddeholm	2007-07-01	2010-06-30	Investigation of interaction between deoxidised steel melts and oxidic materials during ladle metallurgy. Development and practical verification of optimised slag compositions and treatment strategies for inclusion voidance and removal for improved steel cleanness.
48	RFSR-CT-2007-00007	Resource-saving operation and control of stainless steel refining in VOD and AOD process	OPCon-Stainless	EUR 25087 EN	Kobolde, KTH, Outokumpu, SMS Mevac, Arconi, BFI	2007-07-01	2010-06-30	The objective of the project was to improve the operation and control of stainless steel refining within the VOD and the AOD process with respect to the main metallurgical operations. This was achieved by detailed investigations with CFD based process models, and by application of dynamic models for on-line observation and control of the process.
49	RFSR-CT-2008-00006	Active tundish metallurgy	AcTuM	EUR 25875 EN	Aalto U., DEW, Technalia, Gerdau Investigation, OVAKO BAR, TATA UK, Bergakademie Freiberg	2008-07-01	2011-06-30	The project aimed at improved, better guaranteed steel cleanness by applying tailored tundish slag with high capacity to efficiently absorb macro- and micro-inclusions from different steels. Fundamental studies on factors influencing inclusion removal and inclusion cleanliness in tundish as well as thermodynamic calculations showed that more basic slag would lead to a more effective tundish slag having higher capacity to absorb inclusions compared to standard practice.
50	RFCS-CT-2008-00003	Optimized production of low C and N steel grades via the steelmaking route	LOWCNEAF	EUR 25869 EN	BFI, AM Olaberria, CRM, Gerdau, PTG, Riva	2008-07-01	2011-12-31	Within this project through process control strategies were developed for the reliable achievement of low C and N contents within the EAF route under minimum costs. In this context dynamic process models for the EAF for on-line calculation of C and N content, and for the VD plant regarding degassing and temperature behaviour were applied at several plants.

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51	RFSR-CT-2008-00044	Enhanced reliability in ladle refining processes (VD, VOD and LF) by improved on-line process monitoring and control	LAREFMON	EUR 25947 EN	AMR, Gerdau Voestalpine, BFI	2008-12-01	2011-11-30	The objective of this project was to improve the reliability of vacuum degassing and ladle furnace treatment by joint application of new thermal imaging-based evaluation of stirring efficiency and improved dynamic process models. Enhanced online monitoring and control systems were developed and applied for reliable control and improved performance of the main metallurgical ladle refining processes. Among others, an IR-camera was successfully applied to monitor the melt bath surface during VD treatment.
52	RFSR-CT-2009-00003	Enhanced steel ladle life by improving the resistance of lining to thermal, thermomechanical and thermochemical alteration	Ladlife	EUR 26689 EN	Gerdau I+D, CSM, BFI, Lucchini	2009-07-01	2012-06-30	Ladle refractory wear is an important concern for steelmakers, not only for the material cost but also for its influence on plant productivity and safety. This project aims at enhancing ladle lining life, helping steelmakers in decisions about materials to use and in scheduling of maintenance operations. This will be achieved by model based soft sensors and laboratory work. The wear of ladle lining is mainly due to its cyclic interaction with steel and slag during its normal operation. The understanding of the chemical, thermo-chemical and thermo-mechanical reactions in the metal-slag-refractory system is the key to reach the planned goal.
53	RFSR-CT-2010-00003	Multi-criteria through-process optimisation of liquid steelmaking	TOTOPTLIS	EUR 26931 EN	CSM, AME, Lucchini, PTG, BFI	2010-07-01	2013-12-31	Main objective of this on-going project is the development of a through-process optimisation for the liquid steelmaking route. Real-time monitoring and predictive models, using process and sensor data from different aggregates, shall be integrated for a multi-criteria optimisation of material and energy input regarding quality, productivity and costs. A dynamic modification of the planned process route will be suggested in case of deviations in quality relevant parameters.
54	RFSR-CT-2010-00005	Increased yield and enhanced steel quality by improved deslagging and slag conditioning	OPTDESLAG	EUR 27438 EN	Mefos, Saarschmiede, SSAB, BFI	2010-07-01	2013-06-30	In this project, CCD and infrared cameras and imaging systems were installed to monitor and improve ladle deslagging operations. Based on the image analysis the amount of remaining slag on the melt bath was estimated. The latter information was used as additional input for a slag balance model, to calculate slag amount and composition throughout ladle treatment and to derive set-points for slag former additions.
55	RFSR-CT-2011-00004	Intelligent cleanness control in secondary steelmaking by advanced off-line and on-line process models	IntCleanCon	EUR 27832 EN	Tecnalia, Gerdau, DEW, BFI	2011-07-01	2014-12-31	Within this project CFD and on-line prediction models were developed and applied for advanced industrial control strategies and practices in secondary metallurgy, in order to guarantee highest steel cleanness levels for high quality steels. On-line control strategies, based on a combination of through-process models and new monitoring and control techniques for stirring during ladle metallurgy processes, were used for reliable achievement of improved cleanness and castability

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56	RFSR-CT-2012-00005	Stirring plug monitoring system for improvement of plug availability and stirring performance	PlugWatch	not yet published	Terni, CSM, DEW, Gerdau, BFI	2012-07-01	2015-06-30	The aim of this research project is the development and installation of online monitoring systems for stirring plugs in steel ladles in order to determine and predict their availability and performance for stirring processes.
57	RFSR-CT-2013-00030	Environmental impact evaluation and effective management of resources in the EAF steelmaking	EIRES	still running	Scuola Superiore Sant´Anna, CSM, Dalmine, DEW, Gerdau, Ori Martin, RIVA, Tecnalia, BFI	2013-07-01	2016-12-31	This ongoing project aims at defining a methodology for the assessment of the environmental impact of EAF steelmaking plants. Emissions into air, water and soil, as well as energy, water and wastes management, properly measured and weighted, will contribute to the definition of a global index. Moreover, simulation models for the plants of the EAF steelmaking route will be developed to predict the environmental impact of process modifications.
58	RFSR-CT-2014-00006	Improving steelmaking processes by enhancing thermal state ladle monitoring	LADTHERM	still running	AMB, Gerdau, KTH, BFI	2014-07-01	2017-12-31	This project aims to monitor the thermal state of steelmaking ladles during secondary steelmaking operations. Refractory temperature measurements will provide online information to accompanying thermal models for the ladle lining. This is a new input parameter for ladle thermal state monitoring systems to optimize the use of thermal energy stored in the ladle lining.
59	RFSR-CT-2015-00004	Dynamic stirring for improvement of energy efficiency in secondary steelmaking	DYNSTIR	still running	CSM, GMH, KTH, Udeholm, BFI	2015-07-01	2018-06-30	The project objective is to improve ladle stirring by developing dynamic stirring policies in secondary steelmaking at different treatment stations (CAS-OB, VD and FT). In heat-individual dynamic stirring, the stirring process will be tailored to the individual need of each treated steel melt, based on metallurgical fundamentals, with the aim to improve the energy efficiency of the ladle stirring processes while maintaining the cleanness of the final product. Imaging and vibration measurement systems will be used to monitor the actual stirring, compare it to the ideal treatment according to the stirring policies and advise correct stirring accordingly.
60	RFSP-CT-2015-00026	Plant wide control of steel bath temperature	PlantTemp	still running	GMH,BFI	2015-07-01	2018-06-30	The objective of this P&D project is to develop an operator advisory system for through-process monitoring and control of the liquid steel temperature in order to improve the accuracy in meeting the target casting temperature with minimisation of energy and material consumptions. The through-process control system shall be based on enhanced dynamic models and measurement procedures covering the complete process chain of electric steelmaking from the superheating phase in the EAF up to the end of the casting process in the tundish.