Contributions related to the control of steel ingot solidification

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Abstract. The paper introduces the influence of the control over steel ingot solidification upon the quality characteristics of carbon steels. The laboratory experiments focused on the solidification control of steel ingots with cylindrical cross-section, by addition of crystallizing germs (micro-coolers) in their central area, in order to influence their inner structure and quality characteristics. The use of graphical and analytical correlations allows the establishing of optimal technological domains of variation for the steel casting parameters, with use of micro-coolers, in order to obtain the desired values for their mechanical characteristics.

1. Introduction

The basic problems that must be resolved casting steel it consist in obtain of homogeneous ingots from chemical point of view structural and mechanic properties. To mitigate the deficiency of ingots solidification in case of classical cast is necessary to adapt an efficient method to evacuate the heat from the steel in course of solidification. Usually the rapid heat evacuate is ensured through the creation of suddenly gradient of temperature in parts that solidification, as in liquid phase of the ingot. In this case, excepting the over heating must be field in most part and physic heat of cooling of the steel overlay that had been solidificated [1]. Conducting the crystalline structure can be realized using the temperature gradient (considerate basic parameter) from the liquid phase adjoining with the solidificated ingots font.

To conduct the solidification it can be utilized three methods, namely [2]:

- Using an alternative or continuous magnetic field for stopping the contraction of the currents from the liquid steel from the middle of the block of changing the movement direction
- Using the micro-coolers under forms of powder or granules metallic who reduce the gradient of temperature and influence the circulation of steel not solidified
- Enlarging the speed of solidification steel.

The micro-coolers used leads to reduce the piping extent, of the segregation, to improve the solidification structure and for values for physic-mechanic characteristic.

The method of ingot casting with micro-coolers is particularly recommended for the casting of large steel ingots, which are most likely to develop flaws such as: segregations, micro-shrinkages axial porosities and hot cracks. The process of steel crystallizing with exogenous germs introduced by means of micro-coolers differs considerably from the one used in common cast steel.

The micro-coolers introduced into the liquid alloy during casting, take over the overheat and also part of the solidification heat, some of them remaining into the liquid alloy as crystallizing germs. In order to obtain the desired effect, the micro-coolers have to be evenly distributed into the mass of

Contributions to steel semi-finished parts quality improvements

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Abstract. The quality of finite steel products depends on steel content of hydrogen. On steel elaboration, in order to remove the dissolved hydrogen, at least one ladle secondary treatment is needed. The paper introduces the results obtained in the increase of hydrogen removal output, during steel secondary treatment inside the LF installation. Correlations were established between the hydrogen removal rate and the parameters of the secondary treatment (bubbling flow, bubbling time and bubbling pressures).

1. Introduction

Practically, during the usual elaboration, the hydrogen content of steel frequently varies between 1.8 – 10 ppm, and if the steel is the subject of the secondary treatment and vacuum casting metallurgy, the content of hydrogen is of maximum 1.8 – 2.2 ppm [1].

The main sources from which the hydrogen can turn into steel in liquid condition are: the metallic load and all the other materials used in the elaboration and casting, refractory materials, cooled elements of the oven and of installations for the treatment of liquid steel, humidity of the atmosphere in which one works, etc. The content of hydrogen must be limited in steel because it has negative effects on the semi-finished or on the finished products [4].

The negative influence of the hydrogen in steel can be observed in the following [2]:

- is one of the causes of breaths in steel ingots and castings of calm steels;
- contributes to the defect called "flakes" (tiny cracks) in steels alloyed with chromium and nickel, which substantially reduce the fatigue strength of steel parts;
- reduces the plasticity and tenacity of steel;
- affects the electrical and magnetic properties of the steels.

2. Experimental Research

The industrial experimentations regarding the influence of the slag characteristics on the hydrogen removal efficiency were performed on a technological flow of processing the steel made of an electric arc furnace, EBT type of 100 t capacity, LF installation and continuous cast installation with 5 wires.

At the secondary treatment of the steel in the LF installation the argon bubbling of the metallic bath takes place and also the addition for correcting the chemical composition and for deoxidation and desulphuration as well as the additions for reducing slag formation (lime, bauxite).The duration of the secondary treatment of the steel is 50-90 minutes, required by the timing with the continuous cast installation [3, 4]. To determine the hydrogen removal efficiency, samples of hydrogen were taken, before the insertion of the steel ladle in the LF installation and at the end of the treatment.

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THE INFLUENCE OF MICRO COOLERS ON THE PHYSICAL-MECHANICAL CHARACTERISTICS OF THE STEELS USED IN MAKING RAILWAY MONOBLOCK WHEELS

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Original scientific paper
The paper introduces the possibilities of improving mechanical characteristics of the steels used in making railway monoblock wheels, by using micro coolers on steel casting. The laboratory experiments are aimed at studying the control of round cross-section steel ingot solidification by adding crystallization germs in their central area, in order to influence the internal structure and the mechanical characteristics of the steel. The stimulation of heterogeneous germination on the surfaces generated by the particles introduced in the center of the ingot, while it was in a liquid state, leads to the formation of a second solidification front and heat absorption in this area. The data we obtained during the research have been processed in Excel, in order to obtain the correlation equations that express the variation of the steel mechanical characteristics as a function of the chemical structure both for the experimental samples and for the reference ones.

Keywords: *improvement, micro coolers, physical-mechanical characteristics, railway monoblock wheels, steel*

Utjecaj mikro rashlađivača na fizkalno-mehaničke karakteristike čelika korištenih u izradi željezničkih monoblok kotača

Izvorni znanstveni članak
U radu se razmatraju mogućnosti poboljšanja mehaničkih svojstava čelika koji se koriste u izradi željezničkih kotača iz jednog bloka, korištenjem mikro rashlađivača kod lijevanja čelika. Cilj je laboratorijskih eksperimenata bio proučavanje skrućivanja čeličnih ingota kružnog presjeka dodavanjem kristalizacijskih klica u njihovo centralno područje kako bi se utjecalo na unutarnju strukturu i mehanička svojstva čelika. Stimulacija heterogenog klijanja na površinama, generiranog česticama umetnutima u središte ingota dok je bio u tekućem stanju, dovodi do stvaranja drugog ukrućenog sloja i apsorpcije topline u tom području. Podaci koje smo dobili tijekom istraživanja obrađeni su u Excelu da bi se dobile korelacijske jednadžbe kojima se izražavaju varijacije mehaničkih karakteristika čelika kao funkcije kemijske strukture za eksperimentalne kao i za referentne uzorke.

Ključne riječi: *poboljšanje, mikro rashlađivači, fizikalno-mehančke karakteristike, željeznički monoblok kotači, čelik*

1 Introduction

Railway monoblock wheels are subjected to particularly complex strains, so they have to meet highly exigent quality criteria both in terms of material and surface quality and dimensional accuracy. In the case of monoblock wheels, there are several materials that qualitatively correspond to the high quality carbon steels [1].

The values of the mechanical characteristics depend on the quality of the material. These characteristics can be improved by controlling the solidification of the steel cast into ingots meant for manufacturing monoblock wheels.

The basic problem that has to be solved when casting steel consists in obtaining ingots as homogeneous as possible chemically, structurally and mechanically. In order to dim out the flaws in ingot solidification in the case of classical casting, it is necessary to approach an efficient method of releasing the heat from the steel in the course of solidification [2]. A quick removal of heat is granted by the creation of an abrupt temperature gradient in the solidifying parts, as well as in the ingot liquid phase. In this case, besides the overheating temperature, the physical cooling temperature of the solidified steel will have to be transferred for the most part. In the case of casting circular cross section ingots meant for manufacturing monoblock wheels, as compared to the square cross section ones, (let aside the rectangular ones), for the same ingot cross section, the lateral surface of the round ingots is smaller than that of the square ones, so heat transfer is lower.

The intensity of the heat transfer in the process of liquid steel solidification influences the casting structure (the extension of solidification areas), the grain size, the segregation and through these, the mechanical characteristics. A particular importance during the solidification process, particularly in the case of the ingots under study, is to be given to the generation of crystallization germs into the mass of the steel, which also determines the control of the solidification process. The control of the crystalline structure can be achieved by means of the temperature gradient (considered to be a basic parameter) in the liquid phase neighbouring the ingot solidification front.

The research done upon the possibilities of controlling the solidification process, has brought forth the fact that the basic parameters are: the temperature gradient in the liquid and solid phases, the length of the bi-phasic zone, the kinetics of solid phase separation in the solidification interval as function of the balance diagram and the thermal-physical properties of the steel [3].

In order to control the solidification, we used the addition of micro-coolers in the form of metallic powder or grains, which reduce the temperature quotient and influence the circulation of the non-solidified steel. The use of micro-coolers leads to the reduction of shrinkage extent, of segregation, and to an improvement of the solidification structure and of the physical and mechanical characteristics.

2 Laboratory experiments

On the European Union railway network the steel grade most widely used is R7T [4], as it is non-alloyed, corresponding to the chemical composition of OLC 55, steel used in the laboratory experiments.

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Researches Regarding the Improvement of the Steel Quality

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Keywords: steel, hydrogen, ladle furnace, slag, refining

Abstract. This paper presents the results obtained in what concerns the ranges of technological parameters of the secondary treatment of steel in LF plants to improve its quality by reducing the hydrogen content. The use in the industrial practice of the optimum values for these parameters allows obtaining steels with a low content of gases, especially hydrogen.

Introduction

In what concerns the management of noxious gas content for steel, that is hydrogen or nitrogen, we can say that this is possible from the phase of loading the scrap iron in the furnace by avoiding the use of a moist load, using calcined flux, and of some ferroalloys with low nitrogen content [1].

The main parameters that influence the content of hydrogen in steel are [2]:

- moisture content of natural gas used as an adjunct to melt, resulting in some cases to values of 9.7 to 10 ppm of hydrogen in the bath metal from the furnace;
- moisture of the carbon used for injecting the foaming slag, coming from petroleum coke fine-grained;
- the atmosphere of the aggregation unit (avoiding water leaks in the ladle furnace);
- the discharge duration of the steel from the furnace (4-9 min) into the ladle. It is directly influenced by the diameter of the outlet respectively the shape and lateral surface of the steel flow during discharge;
- the duration of maintaining the steel in the ladle (after evacuation) without administration of newly formed slag in the ladle added to the furnace.

The main factors that may influence the absorption and desorption of hydrogen are the gas bubbling parameters, the pressure and flow (argon), humidity of the lime and bauxite.

Industrial experiments

The content of hydrogen in steel affects its quality. We analyzed the evolution of hydrogen content in steel during the elaboration, treatment and casting steel in electric steel plant equipped with type EBT –EAF- LF secondary treatment plant and continuous casting. They followed a series of parameters [3]: the composition of metal and filler load in the furnace and treatment ladle, load humidity, the characteristics of the slag, the metal bath temperature, the hydrogen content of the steel prior to discharge from the furnace, in the LF facility prior to treatment and respectively at the end and in the continuous casting distributor and bubbling with argon in the system parameters in the LF facility (flow, pressure, duration, metal bath temperature).

Processing steel in the LF facility influences mostly the content of hydrogen in steel, or its removal efficiency. In order to determine the influence of the technological parameters for processing the steel in a secondary treatment facility on the content of hydrogen in the steel, the hydrogen removal efficiency was considered as a dependent parameter and the argon flow rate, the argon bubbling duration, the pressure of argon in bubbling and the temperature of the steel as independent parameters. Data processing was performed in Excel. The results are shown analytically and graphically in figure 1-11.

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Researches on the influence of the slags formed in the installations on the hydrogen removal efficiency(•)

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Abstract

Modern technology requires ever more high-quality steel and special steels, with properties corresponding to very different purposes. Because of the interdependence of the factors that determine the overall quality of the steel and those who determine the gas content, this is an issue of growing importance for the development, treatment and casting of steel. Slag plays an important part in the development phase no matter the process phase is. The influence of synthetic slags during LF treatment facility is examined based on the degree of removal of hydrogen. After processing the experimental data there has been established the optimal basicity variation on which one can determine the chemical composition of slag (CaO, SiO_2, Al_2O_3, MgO) for the secondary treatment of steel.

Keywords

Slag; Hydrogen; Steel; Solidification; Efficiency.

Investigaciones sobre la influencia de la escoria sobre el rendimiento de eliminación del hidrógeno

Resumen

La técnica moderna necesita cada vez más acero de calidad superior y aceros especiales, con propiedades adecuadas a unos propósitos muy amplios. Gracias a la interdependecia entre los factores que determinan el contenido de gases esta constituye un problema cada vez más importante para la elaboración, tratamiento y fundición de los aceros. Una gran importancia en el proceso de elaboración le corresponde a la escoria independientemente de la fase del proceso. Se analiza la influencia de la escoria sintética durante el tratamiento en la instalación LF sobre el grado de eliminación del hidrogeno. Después de procesar los datos experimentales se establecieron los campos óptimos de variación de la basicidad en base a la cual se puede determinar la composición química de la escoria (CaO, SiO_2, Al_2O_3, MgO) para el tratamiento secundario del acero.

Palabras clave

Escoria; Hidrógeno; Acero; Solidificación; Rendimiento.

1. INTRODUCTION

The properties of a steel depend mostly on a series of agents, including the chemical composition of the steel, nature, mold, distribution and quantity of the non metallic inclusions, gas content, cast temperature, cast speed, degree of plastic deformation and the thermal treatment applied[1].

In the case of the semi-finished from steel, one of the causes that leads to worsening their quality is because of the hydrogen content. This can be found in steel in an atomic, molecular and other simple combinations state. Having the atomic radius smaller than the steel one, it ranks interstitially and creates a solid solution with the mass basis. It doesn't make chemical combinations with the iron or other elements that are dissolved into steel. In a molecular state it locates itself in pockets and microcavities contributing to their formation. The hydrogen quantity that is dissolved in steel depends on a series of agents, some of them being[2-4] the temperature of the steel, work pressure in the oven and in liquid steel treatment installation, chemical composition of the steel, elaboration and casting procedure etc.

Practically, during the usual elaboration, the hydrogen content of steel frequently varies between 1.8 - 10 ppm, and if the steel is the subject of the

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Researches regarding the recovery of small and powder ferrous wastes within iron-and-steel industry (Conference Paper)

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Abstract

View references (7)

Waste recycling represents one of the economic solutions of environment ecology. In this sense the group of authors has made a series of experimentations regarding their transformation in used products in the iron-and-steel industry. To obtain the products in forms of briquettes many series of receipts have been tested and according to qualitative characteristics of the obtained products the processing receipts have been chosen. The data obtained has been processed in the computation program Matlab, program that allowed the establishing of optimal domains of variations of the technological parameters in view of obtaining some products with superior technological characteristics.

Author keywords

Briquette; Capitalization; Ferrous waste; Siderurgy; Sustainable development

Indexed keywords

Briquette; Capitalization; Computation program; Economic solutions; Ferrous waste; Optimal domain; Siderurgy; Technological parameters; Used product; Waste recycling

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Researches regarding the recovery of small and powder ferrous wastes within iron-and-steel industry

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Abstract: - Waste recycling represents one of the economic solutions of environment ecology. In this sense the group of authors has made a series of experimentations regarding their transformation in used products in the iron-and-steel industry. To obtain the products in forms of briquettes many series of receipts have been tested and according to qualitative characteristics of the obtained products the processing receipts have been chosen. The data obtained has been processed in the computation program Matlab, program that allowed the establishing of optimal domains of variations of the technological parameters in view of obtaining some products with superior technological characteristics.

Key-Words: - ferrous waste, siderurgy, briquette, capitalization, sustainable development

1. Introduction

In the last decade, manufacturing technologies for metallic materials all over the world have reached a high performance level, demonstrating a high capacity to adapt to the changes due to conditions imposed on raw materials and energy, necessary to increase productivity and decrease specific use, as well as obeying to stricter environmental regulations. The remarkable results obtained in modern iron factories were possible through implementation of management systems into industrial activity, systems which imposed the analysis, evaluation and selection on changes at the level of technologies/equipments, respectively alternative technologies, from the perspective of its specific instruments, among which one of the most complex is undoubtedly the life cycle analysis [1].

For Romania the recovery of ferrous wastes represents a priority for the durable development strategy because the natural resources of some raw materials categories are poor or insufficient and the resources can substitute part of the raw materials with significant low costs. Comparatively with the practice and the world wide manifested tendencies, the Romanian industry registers gaps in the powder wastes collection, transportation and storage area, as well as in that of the recovery technologies area by their recycling or reusing [2]. Thereby, the approach of the superior recovery of small and powder ferrous wastes problem was considered necessary and convenient

Pulverous ferrous wastes are present in all cases in the form of oxides. For the recovery of iron, they must be objects in a reduction process, either in a furnace, case in which these wastes are components of the raw material (previously processed as pellets, briquettes or agglomerate), or in electric arc furnaces, as secondary material with a complex fusing - oxidizing character or as a slag foaming agent. In countries with a well-developed iron industry, pulverous ferrous wastes are recovered in a proportion of over 90% through re-introduction in the siderurgical circuit. The works written of this theme state that this recovery is practised with several technologies, namely [3,4,5]:

- *Recovery through agglomeration* - in this processing technology, pulverous ferrous wastes (steel plants dust) compose the agglomeration charge in a proportion of 2-3% (sometimes together with other ferrous wastes like sunder, blast furnace flue dust, agglomeration dust, etc.). The obtained agglomerate is later used as raw material in furnace charge;

- *Recovery through pelletizing* - this technology involves using steel plant dust as unique component in the agglomeration charge, or in a mixture with pulverous ferrous ore or other pulverous wastes for producing pellets. The obtained pellets, according to their quality, determined mainly by the processing technology, can be used: in furnace charges, as raw material, together with agglomerate, and, eventually, ore; in reduction equipment charge, to obtain metallized pellets and

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POSSIBILITIES OF RECYCLING THE LIME-DOLOMITE PLANT DUST

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Abstract. In the field of the environment protection, alignment according to the standards of the European Union is a complex and continuous process that assures the compatibility of the solutions for the environment problems in Romania with the ones adopted by the European Union. The integration of the environment politics into the politics and the sectorial strategies represents an essential condition of this process. One of the most important actions, which led to the ecological recovery and to the improvement of the environment conditions, was represented by the harmonisation of the environment laws with the EU laws, as an important part of the adhesion process. Currently, a priority is given to strictly accomplish the commitments assumed by Romania in the process of negotiation of the environment chapter, both institutional and especially financial, which can lead to the creation of an environment infrastructure according to the European requests and to assure a clean and healthy environment. Based on some research regarding the present de-dusting process of gases resulted in technological process in lime, dolomite and talc plant, this paper presents a few technological solution for dust recycling, resulting in de-dusting installations.

Keywords: recycling, lime, wastes, briquette, electric steel plant.

AIMS AND BACKGROUND

Industrial processes result in various wastes that are partially recovered and partially released in the atmosphere. Pollution caused by these wastes affects water, air and soil alike, leading in time to irreversible biodiversity destruction.

The study herein approaches the pollution created by the industrial lime and dolomite factories. In spite of the fact that, from the point of view of toxicity, the values are a little over the acceptable limits, the real pollution is a lot higher. Due to geographic and climatic conditions, the pollution covers an area of 6 km downward the industrial platform (Fig.1) and an area of about 1.5–2 km upward[1,2] (pollution agents, specifically determined, being the carbonate dust, oxides and burned gases).

* For correspondence.

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RESEARCHES REGARDING PRACTICAL APPLICATION OF DEFERRISED STEELSHOP SLAGS IN AGRICULTURE

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Abstract. The transposition of the communitarian acquis regarding the environment protection in the national legislation and its implementation represents one of the main challenges Romania confronts with within the process of adhering at the European Union. In this context the industrial wastes represent one of the important problems of the environment safety policy, the efforts made being found in the sphere of harmonising the national stipulations with those of the European Union. The management of the industrial wastes consists in their exploitation, storage and final disposal or cremation. The weight of these options is about the same in average every year, namely: storage 81%, exploitation 15%, and temporary storage 3.3%, respectively cremation 0.7%. In Romania, the waste storing outside represents the most important way of removing the industrial wastes, over 80% of the wastes generated are stored every year. The use in agriculture of the deferrised slag allows the development of some existing methods regarding the influence of the slag addition in the soil upon the plant growing and development. The proposed technology does not generate other pollution sources and it is efficient from the economic point of view, it can be implemented in practice either by the producers of such wastes or by other firms using deferrised slag. The use in other sectors of the steel shop slag leads to release the surfaces occupied by these wastes and render them to the respective natural landscape, there takes place a reduction of the pollution degree in the regions having steel industry.

Keywords: waste, environment, slag, agriculture, plants.

AIMS AND BACKGROUND

In the process of steel elaboration, aside from the main product of the steel plant (ingot and/or continuous cast semi-finished part) there are also by-products like: slag, gas and dust. After year 2007, Romania, as the EU member state, is supposed to meet the European requirements with respect to the environment, which implies the management and turning into account of steel industry wastes, by non-pollutant technologies.

In time, Romania has accumulated a large quantity of wastes. Large areas are occupied by mining gangue dumps, deposits of ash resulting from the thermal and electric power stations, slag dumps from the steel plants, and depots of industrial

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RESEARCH REGARDING USING THE WASTES WITH CARBON CONTENT IN SIDERURGICAL INDUSTRY

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Abstract. CARBON FER is a mechanical mixture obtained out of various powder or ground to powder ferrous or non-ferrous wastes. The ferrous powder wastes that can be used are steel dust, soot, agglomeration and blast furnace dust as well as non-ferrous coke dust; the wastes to be ground can be small-size coke pieces, electrode and carbonic block wastes. The use of CARBON FER as substitute for the usual slag foaming agents in electric furnaces has both an ecological and economical aspect. The ecological aspect refers to the significant cut down in environment pollution (an increase of powder waste use and reduction of the space needed for its dumping). The economical aspect is represented by the transfer of expenditures involved by waste dumping towards other needs. Experimental results show the following effects: the recovery of 45–75% of the iron present in the injected material; the quality of steel stays unchanged and there is no negative impact on the furnace; the quantity of powder wastes generated in the stee-lmaking processes is diminished; the steel dust is richer in zinc and lead.

Keywords: wastes, milling, scalp, steel plant, injected.

AIMS AND BACKGROUND

Up to the present day, CARBON FER has been used world-wide in cast iron elaboration in the blast furnace, it being blown, mixed up with coal powder, into the tuyeres, and also in electric arc steel elaboration, as slag foaming agent[1,2].

The wastes contain enough elements such as iron, calcium or carbon that can be useful during various processes taking place inside the steel-making facilities.

In order to obtain CARBON FER, the following technological stages are needed[3]:

– temporary depositing of each type of waste or material, separately;

– screening each type of waste (material), the rough fraction to be ground and the fine grain to be deposited temporarily;

– proportional dosage of the components according to the recipe and their introduction into the homogenising drum;

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Simulation of continuous cast steel product solidification*

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Abstract

Primary cooling – inside the tundish – has a great impact over the thickness of the solidified steel crust. If on exiting the tundish the crust is too thin, it can punch and break, as a result of the ferrostatic pressure exerted from the inside by the liquid steel as well as because of the weight of the molten steel. The parameters that influence the amount of dissipated heat depend on the cooling water flow of the tundish, on the pressure and temperature of the cooling water but also on the overheating of the continuously cast steel. The secondary cooling takes place at the exit of the semi-finished product from the tundish, when the solidification is supposed to take place all along the cross section of the strand. In order to achieve it, in addition to a correctly managed primary cooling, it is necessary to obtain the proper correlation of the factors that influence the secondary cooling as well: the water flow rate long the three zones of the installation and its pressure in the secondary circuit. All these have in view a proper solidification length; an intense cooling can generate cracks due to the thermal stress, while a too slow cooling can generate a partial solidification of the strand up to the cropping machine area[1 y 2]. The paper presents a mathematical simulation of the continuously cast steel solidification.

Keywords

Simulation. Continuous casting. Semi-finished product. Primary cooling. Secondary cooling.

Simulación de la solidificación de los semiproductos de acero, fundidos continuamente

Resumen

El enfriamiento primario del cristalizador tiene una gran importancia sobre el espesor de la costra de acero solidificado. Si al salir del cristalizador, esta costra es demasiado sutil, bajo la acción de la presión ferro estática ejercitada por el acero líquido del interior y gracias el peso propio del hilo, ésta, puede perforar resultando su rompimiento. Los parámetros que influenyen sobre la cantidad de calor cedida dependen del agua de enfriamiento del catalizador, de la presión y de la temperatura de agua de enfriamiento, pero también del sobrecalentamiento del acero fundido continuamente. A la salida del semiproducto del cristalizador, tiene lugar el enfriamiento secundario, a lo largo del que la solidificación tiene que realizarse en toda la sección transversal del hilo. Para eso, además de un enfriamiento primario manejado correctamente, tienen que correlacionarse a los factores que influyen en el enfriamiento secundario, también; el flujo del agua en las tres zonas de la instalación, la presión del agua en el circuito secundario, etc. Todo esto tiene que ver con una longitud correspondiente de solidificación; un enfriamiento intenso que puede llevar a la aparición de grietas debidas a las tensiones térmicas y un enfriamiento lento puede llevar a una solidificación parcial del hilo hasta la zona del agregado de flujo[1 y 2]. El trabajo representa un modelo de simulación de la solidificación de los semiproductos de acero fundidos continuamente.

Palabras clave

Simulación. Colada continua. Semiproducto. Enfriamiento primario. Enfriamiento secundario.

* Trabajo recibido el día 17 de abril de 2006 y aceptado en su forma final el día 22 de diciembre de 2006.
** University "Politechnica", Timisoara, Faculty of Engineering, Hunedoara, STr. Revolutiei, 5, 331128, Hunedoara, Romania.

Contributions related to the control of steel ingot solidification

By: Socalici, A (Socalici, A.)[1]; Popa, E (Popa, E.)[1]; Heput, T (Heput, T.)[1]; Vilceanu, L (Vilceanu, L.)[1]

Book Group Author(s): IOP

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Conference: International Conference on Applied Sciences (ICAS)
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Abstract

The paper introduces the influence of the control over steel ingot solidification upon the quality characteristics of carbon steels. The laboratory experiments focused on the solidification control of steel ingots with cylindrical cross-section, by addition of crystallizing germs (micro-coolers) in their central area, in order to influence their inner structure and quality characteristics. The use of graphical and analytical correlations allows the establishing of optimal technological domains of variation for the steel casting parameters, with use of micro-coolers, in order to obtain the desired values for their mechanical characteristics.

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Contributions to steel semi-finished parts quality improvements

By: Socalici, A (Socalici, A.)[1]; Popa, E (Popa, E.)[1]; Heput, T (Heput, T.)[1]; Putan, V (Putan, V.)[1]

Book Group Author(s): IOP

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Conference: International Conference on Applied Sciences (ICAS)
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Date: OCT 26-27, 2013
Sponsor(s): Politehnica Univ Timisoara; Sci Interdisciplinary Values Educ & Res Soc; Wuhan Univ; Huazhong Univ Sci & Technol; S C Miro Mega HD S A

Abstract

The quality of finite steel products depends on steel content of hydrogen. On steel elaboration, in order to remove the dissolved hydrogen, at least one ladle secondary treatment is needed. The paper introduces the results obtained in the increase of hydrogen removal output, during steel secondary treatment inside the LF installation. Correlations were established between the hydrogen removal rate and the parameters of the secondary treatment (bubbling flow, bubbling time and bubbling pressures).

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THE INFLUENCE OF MICRO COOLERS ON THE PHYSICAL-MECHANICAL CHARACTERISTICS OF THE STEELS USED IN MAKING RAILWAY MONOBLOCK WHEELS

By: Andronache, C (Andronache, Constantin)[1]; Socalici, A (Socalici, Ana)[1]; Heput, T (Heput, Teodor)[1]

TEHNICKI VJESNIK-TECHNICAL GAZETTE
Volume: 20 **Issue:** 3 **Pages:** 419-423
Published: JUN 2013
View Journal Information

Abstract

The paper introduces the possibilities of improving mechanical characteristics of the steels used in making railway monoblock wheels, by using micro coolers on steel casting. The laboratory experiments are aimed at studying the control of round cross-section steel ingot solidification by adding crystallization germs in their central area, in order to influence the internal structure and the mechanical characteristics of the steel. The stimulation of heterogeneous germination on the surfaces generated by the particles introduced in the center of the ingot, while it was in a liquid state, leads to the formation of a second solidification front and heat absorption in this area. The data we obtained during the research have been processed in Excel, in order to obtain the correlation equations that express the variation of the steel mechanical characteristics as a function of the chemical structure both for the experimental samples and for the reference ones.

Keywords

Author Keywords: improvement; micro coolers; physical-mechanical characteristics; railway monoblock wheels; steel

Author Information

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Publisher

UNIV OSIJEK, TECH FAC, TRG IVANE BRLIC-MAZURANIC 2, SLAVONSKI BROD, HR-35000, CROATIA

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Researches Regarding the Improvement of the Steel Quality

By: Ana, S (Ana, Socalici)[1]; Erika, P (Erika, Popa)[1]; Teodor, H (Teodor, Heput)[1]; Florin, D (Florin, Dragoi)[1]

Edited by: Nicoara, M; Opris, C

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Abstract

This paper presents the results obtained in what concerns the ranges of technological parameters of the secondary treatment of steel in LF plants to improve its quality by reducing the hydrogen content. The use in the industrial practice of the optimum values for these parameters allows obtaining steels with a low content of gases, especially hydrogen.

Keywords

Author Keywords: steel; hydrogen; ladle furnace; slag; refining

Author Information

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Researches on the influence of the slags formed in the installations on the hydrogen removal efficiency

By: Dragoi, F (Dragoi, F.)[1]; Socalici, A (Socalici, A.)[1]; Ardelean, E (Ardelean, E.)[1]; Popa, E (Popa, E.)[1]; Heput, T (Heput, T.)[1]

REVISTA DE METALURGIA
Volume: 47 **Issue:** 6 **Pages:** 477-484
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View Journal Information

Abstract

Modern technology requires ever more high-quality steel and special steels, with properties corresponding to very different purposes. Because of the interdependence of the factors that determine the overall quality of the steel and those who determine the gas content, this is an issue of growing importance for the development, treatment and casting of steel. Slag plays an important part in the development phase no matter the process phase is. The influence of synthetic slags during LF treatment facility is examined based on the degree of removal of hydrogen. After processing the experimental data there has been established the optimal basicity variation on which one can determine the chemical composition of slag (CaO, SiO2, Al2O3, MgO) for the secondary treatment of steel.

Keywords

Author Keywords: Slag; Hydrogen; Steel; Solidification; Efficiency
KeyWords Plus: STEEL

Author Information

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Recent Researches in Energy and Environment - 6th IASME / WSEAS International Conference on Energy and Environment, EE'11

2011, Pages 282-287

6th IASME / WSEAS International Conference on Energy and Environment, EE'11; Cambridge; United Kingdom; 23 February 2011 through 25 February 2011; Code 84937

Researches regarding the recovery of small and powder ferrous wastes within iron-and-steel industry (Conference Paper)

Ana, S. , Teodor, H. , Erika, A. , Marius, A.

Engineering and Management Department, Polytechnic University of Timisoara, Revolutiei Street, no 5, Hunedoara, 331128, Romania

Abstract

View references (7)

Waste recycling represents one of the economic solutions of environment ecology. In this sense the group of authors has made a series of experimentations regarding their transformation in used products in the iron-and-steel industry. To obtain the products in forms of briquettes many series of receipts have been tested and according to qualitative characteristics of the obtained products the processing receipts have been chosen. The data obtained has been processed in the computation program Matlab, program that allowed the establishing of optimal domains of variations of the technological parameters in view of obtaining some products with superior technological characteristics.

Author keywords

Briquette; Capitalization; Ferrous waste; Siderurgy; Sustainable development

Indexed keywords

Briquette; Capitalization; Computation program; Economic solutions; Ferrous waste; Optimal domain; Siderurgy; Technological parameters; Used product; Waste recycling

Engineering controlled terms: Briquets; Briquetting; Energy conversion; Iron; Iron and steel plants; Metal recovery; Steelmaking

Engineering main heading: Iron and steel industry

ISBN: 978-960474274-5 **Source Type:** Conference Proceeding **Original language:** English

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(2004) *Sustainable Development in Steel by Secondary Material Recovery*, pp. 3-5. Cited 2 times.
PRINTECH Publishing House, Bucureşti

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Ilie, A.

(1999) *Research on Materials High Recovery from Steel Powder*. Cited 2 times.
PhD thesis, Scientific supervisor: Prof.dr.eng. Dragomir I., University Politehnica Bucureşti

4 Ardelean, E., Ardelean, M., Heput, T., Socalici, A.
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(2010) *Journal of Environmental Protection and Ecology*, 11 (1), pp. 217-226. Cited 4 times.

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Possibility of capitalization in metallurgy of pulverulent waste with bazic characters
(2008) *3rd International Conference Management of Manufacturing System", Environmental Technologies and Management*, pp. 2-5. Cited 2 times.
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6 *Prevention and Fighting Pollution in the Steel Making, Energetic and Mining Industrial Areas Through the Recycling of Small-size and Powdering Wastes*. Cited 3 times.
Project no. 31-098/2007 Program PN2 - Consortium - CO. Responsable: Prof. dr. eng. Teodor Heput

7 Socalici, A., Heput, T., Ardelean, E., Ardelean, M.
Researches regarding the obtaining of active slag by using reactive admixtures produced from ferrous and basic scrap
(2010) *The 6th WSEAS International Conference on ENERGY, Environment, Ecosystems and Sustainable Development*, pp. 158-163.
Timisoara

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POSSIBILITIES OF RECYCLING THE LIME-DOLOMITE PLANT DUST

By: Ardelean, E (Ardelean, E.)[1]; Ardelean, M (Ardelean, M.)[1]; Heput, T (Heput, T.)[1]; Socalici, A (Socalici, A.)[1]

JOURNAL OF ENVIRONMENTAL PROTECTION AND ECOLOGY
Volume: 11 **Issue:** 1 **Pages:** 217-226
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Abstract

In the field of the environment protection, alignment according to the standards of the European Union is a complex and continuous process that assures the compatibility of the solutions for the environment problems in Romania with the ones adopted by the European Union. The integration of the environment politics into the politics and the sectorial strategies represents an essential condition of this process. One of the most important actions, which led to the ecological recovery and to the improvement of the environment conditions, was represented by the harmonisation of the environment laws with the EU laws, as an important part of the adhesion process. Currently, a priority is given to strictly accomplish the commitments assumed by Romania in the process of negotiation of the environment chapter, both institutional and especially financial, which can lead to the creation of an environment infrastructure according to the European requests and to assure a clean and healthy environment. Based on some research regarding the present de-dusting process of gases resulted in technological process in lime, dolomite and talc plant, this paper presents a few technological solution for dust recycling, resulting in de-dusting installations.

Keywords

Author Keywords: recycling; lime; wastes; briquette; electric steel plant

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RESEARCHES REGARDING PRACTICAL APPLICATION OF DEFERRISED STEELSHOP SLAGS IN AGRICULTURE

By: Socalici, A (Socalici, A.)[1]; Heput, T (Heput, T.)[1]; Ardelean, M (Ardelean, M.)[1]; Ardelean, E (Ardelean, E.)[1]; Putan, V (Putan, V.)[1]

JOURNAL OF ENVIRONMENTAL PROTECTION AND ECOLOGY
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Abstract

The transposition of the communitarian acquis regarding the environment protection in the national legislation and its implementation represents one of the main challenges Romania confronts with within the process of adhering at the European Union. In this context the industrial wastes represent one of the important problems of the environment safety policy, the efforts made being found in the sphere of harmonising the national stipulations with those of the European Union. The management of the industrial wastes consists in their exploitation, storage and final disposal or cremation. The weight of these options is about the same in average every year, namely: storage 81%, exploitation 15%, and temporary storage 3.3%, respectively cremation 0.7%. In Romania, the waste storing outside represents the most important way of removing the industrial wastes, over 80% of the wastes generated are stored every year. The use in agriculture of the deferrised slag allows the development of some existing methods regarding the influence of the slag addition in the soil upon the plant growing and development. The proposed technology does not generate other pollution sources and it is efficient from the economic point of view, it can be implemented in practice either by the producers of such wastes or by other firms using deferrised slag. The use in other sectors of the steel shop slag leads to release the surfaces occupied by these wastes and render them to the respective natural landscape, there takes place a reduction of the pollution degree in the regions having steel industry.

Keywords

Author Keywords: waste; environment; slag; agriculture; plants

Author Information

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RESEARCH REGARDING USING THE WASTES WITH CARBON CONTENT IN SIDERURGICAL INDUSTRY

By: Socalici, A (Socalici, A.)[1]; Heput, T (Heput, T.)[1]; Ardelean, E (Ardelean, E.)[1]; Ardelean, M (Ardelean, M.)[1]

JOURNAL OF ENVIRONMENTAL PROTECTION AND ECOLOGY
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Abstract

CARBON FER is a mechanical mixture obtained out of various powder or ground to powder ferrous or non-ferrous wastes. The ferrous powder wastes that can be used are steel dust, soot, agglomeration and blast furnace dust as well as non-ferrous coke dust; the wastes to be ground can be small-size coke pieces, electrode and carbonic block wastes. The use of CARBON FER as substitute for the usual slag foaming agents in electric furnaces has both an ecological and economical aspect. The ecological aspect refers to the significant cut down in environment pollution (an increase of powder waste use and reduction of the space needed for its dumping). The economical aspect is represented by the transfer of expenditures involved by waste dumping towards other needs. Experimental results show the following effects: the recovery of 45-75% of the iron present in the injected material; the quality of steel stays unchanged and there is no negative impact on the furnace; the quantity of powder wastes generated in the stee-lmaking processes is diminished; the steel dust is richer in zinc and lead.

Keywords

Author Keywords: wastes; milling; scalp; steel plant; injected

Author Information

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Simulation of continuous cast steel product solidification

By: Ardelean, E (Ardelean, E.); Ardelean, M (Ardelean, M.); Socalici, A (Socalici, A.); Heput, T (Heput, T.)

REVISTA DE METALURGIA
Volume: 43 **Issue:** 3 **Pages:** 181-187
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Abstract

Primary cooling - inside the tundish - has a great impact over the thickness of the solidified steel crust. If on exiting the tundish the crust is too thin, it can punch and break, as a result of the ferrostatic pressure exerted from the inside by the liquid steel as well as because of the weight of the molten steel. The parameters that influence the amount of dissipated heat depend on the cooling water flow of the tundish, on the pressure and temperature of the cooling water but also on the overheating of the continuously cast steel. The secondary cooling takes place at the exit of the semi-finished product front the tundish, when the solidification is supposed to take place all along the cross section of the strand. In order to achieve it, in addition to a correctly managed primary cooling, it is necessary to obtain the proper correlation of the factors that influence the secondary cooling as well: the water flow rate long the three zones of the installation and its pressure in the secondary circuit. All these have in view a proper solidification length; an intense cooling can generate cracks due to the thermal stress, while a too slow cooling can generate a partial solidification of the strand up to the cropping machine area([1 y 2]). The paper presents a mathematical simulation of the continuously cast steel solidification.

Keywords

Author Keywords: simulation; continuous casting; semi-finished product; primary cooling; secondary cooling

Author Information

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2014	287	0.579	0.371	0.528	0.049	184	2.6	8.9	0.00052	0.066	100.00	0.05845	26.471
2013	190	0.515	0.348	0.484	0.039	154	2.4	8.3	0.00038	0.063	99.35	0.04239	36.207
2012	133	0.501	0.282	Not A...	0.015	131	2.1	8.7	0.00030	Not A...	95.42	Not A...	43.889
2011	99	0.347	0.099	Not A...	0.033	90	Not A...	8.5	0.00014	Not A...	100.00	Not A...	23.889
2010	14	0.083	0.041	Not A...	0.014	73	Not A...	9.4	0.00008	Not A...	100.00	Not A...	8.621

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ISO: Rev. Metal.
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Categories
METALLURGY & METALLURGICAL ENGINEERING - SCIE

Languages
SPANISH

6 Issues/Year;

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Key Indicators

Year	Total Cites Graph	Journal Impact Factor Graph	Impact Factor Without Journal Self Cites Graph	5 Year Impact Factor Graph	Immediacy Index Graph	Citable Items Graph	Cited Half-Life Graph	Citing Half-Life Graph	Eigenfacto Score Graph	Article Influence Score Graph	% Articles in Citable Items Graph	Normalized Eigenfacto Graph	Average JIF Percentile Graph
2014	195	0.288	0.164	0.374	0.061	33	7.2	9.5	0.00028	0.080	90.91	0.03157	12.838
2013	152	0.355	0.302	0.262	0	36	7.5	9.4	0.00026	0.067	88.89	0.02918	22.000
2012	118	0.241	0.222	0.232	0.154	13	6.1	>10.0	0.00029	0.068	100.00	Not A...	19.079
2011	119	0.202	0.112	0.265	0.026	39	6.0	9.6	0.00027	0.066	87.18	Not A...	16.667
2010	148	0.250	0.119	0.243	0	39	5.8	>10.0	0.00032	0.051	92.31	Not A...	25.658
2009	124	0.261	0.152	0.184	0.073	41	5.6	8.9	0.00026	0.037	95.12	Not A...	26.429
2008	200	0.470	0.192	0.313	0.020	51	5.0	8.9	0.00032	0.039	94.12	Not A...	51.587
2007	184	0.436	0.127	0.372	0	41	3.4	8.5	0.00055	0.063	92.68	Not A...	49.242
2006	287	0.457	0.057	Not A...	0.071	42	3.9	8.8	Not A...	Not A...	97.62	Not A...	57.692
2005	152	0.414	0.096	Not A...	0.026	38	3.5	9.8	Not A...	Not A...	100.00	Not A...	52.985
2004	191	0.798	0.131	Not A...	0.078	51	2.8	8.1	Not A...	Not A...	100.00	Not A...	75.352
2003	107	0.281	0.140	Not A...	0.053	76	4.5	>10.0	Not A...	Not A...	98.68	Not A...	46.528
2002	69	0.131	0.098	Not A...	0.027	37	Not A...	8.2	Not A...	Not A...	94.59	Not A...	21.014
2001	66	0.149	0.135	Not A...	0.012	84	Not A...	>10.0	Not A...	Not A...	97.62	Not A...	27.612
2000	54	0.190	0.114	Not A...	0	28	Not A...	9.6	Not A...	Not A...	96.43	Not A...	31.538
1999	45	0.186	0.127	Not A...	0	41	Not A...	>10.0	Not A...	Not A...	92.68	Not A...	30.833
1998	56	0.169	0.094	Not A...	0.019	53	Not A...	7.9	Not A...	Not A...	92.45	Not A...	36.865

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Titles
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Categories
ENVIRONMENTAL SCIENCES - SCIE

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ENGLISH

4 Issues/Year.

Key Indicators

Year	Total Cites Graph	Journal Impact Factor Graph	Impact Factor Without Journal Self Cites Graph	5 Year Impact Factor Graph	Immediacy Index Graph	Citable Items Graph	Cited Half-Life Graph	Citing Half-Life Graph	Eigenfacto Score Graph	Article Influence Score Graph	% Articles in Citable Items Graph	Normalizec Eigenfacto Graph	Average JIF Percentile Graph
2014	843	0.838	0.114	0.511	0.038	211	3.0	8.5	0.00038	0.022	100.00	0.04232	15.022
2013	475	0.338	0.065	0.369	0.037	163	4.1	9.7	0.00024	0.016	99.39	0.02664	2.083
2012	354	0.259	0.082	0.335	0.069	290	3.8	9.4	0.00026	0.020	99.31	Not A...	2.143
2011	137	0.102	0.085	Not A...	0.050	140	4.9	>10.0	0.00020	Not A...	99.29	Not A...	1.220
2010	141	0.178	0.130	Not A	0.006	179	4.6	>10.0	0.00022	Not A	100.00	Not A	0.259
2009	91	0.168	0.107	Not A	0.008	125	Not A	9.4	0.00019	Not A	99.20	Not A	2.486