

# CONTENTS

## Metalurgia International 5/2008

ISSN 1582 – 2214

|   |   |
|---|---|
| <p>SUSTAINABLE DEVELOPMENT .....5 - 14</p> <p><i>IOANA ADRIAN, NICOLAE AVRAM, BĂLESCU CEZAR:</i><br/>Ecological elements of the electric arc furnace ..... 5</p> <p><i>CALEA GHEORGHE, CRISTINA ȘTEFAN, MARIA NICOLAE:</i><br/>Researches about the measures of the environment improvement ..... 10</p> <p><b>MATERIALS SCIENCE RESEARCH AND DEVELOPMENT ..... 15 – 87</b></p> <p><i>CONSTANTIN NICOLAE, DOBRESCU CRISTIAN, IOANA APOSTOLESCU, RALUCA PETRACHE, BUZDUGA MIRON:</i><br/>Research regarding the physical and chemical characteristics of pre-reduced iron ores and the analysis of the possibilities of their use in the iron and steel elaborating process ..... 15</p> <p><i>DOINA RĂDUCANU, COJOCARU V. DĂNUȚ, BUZAIANU A., CINCA ION, DAN I., SUCIU M.:</i> Structural characteristics of processed Ti-6Al-7Nb alloy in (<math>\alpha+\beta</math>) domain by plastic deformation and heat treatment ..... 21</p> <p><i>CAMELIA PINCA –BRETOTEAN, TIRIAN GELU OVIDIU, LUCIA VÎLCEANU:</i> The effects of the thermal fatigue upon the hot rolling mill cylinders ..... 25</p> <p><i>PĂDUREAN IOAN, NEDELICU DORIAN, ELVIRA PĂDUREAN, ARPAD FAY, TRUȘCULESCU MARIN:</i> Researches upon cavitation erosion resistance of martensitic stainless steel used for molding Kaplan and Francis turbines runner blades ..... 34</p> <p><i>VARGA BELA, ÉVA FAZAKAS, VARGA K.LAJOS:</i> Preparation of nanocrystalline Al<sub>100-x</sub>Si<sub>x</sub> (6 &lt; x &lt; 40) based alloys by rapid solidification methods ..... 41</p> <p><i>BORDEI MARIAN, ANISOARA CIOCAN, FLORENTINA POTECAȘU, ALEXANDRU PETRICA:</i> Blast furnace iron lining runners in term of structural characterisation ..... 45</p> | <p><i>ARDELEAN MARIUS, HEPUȚ TEODOR, ERIKA ARDELEAN, ANA SOCALICI, LUCIA VÎLCEANU:</i> New methods and analysis functioning techniques for cooling bed tool of the profile laminators ..... 48</p> <p><i>MILOSAN IOAN:</i> Some aspects about Mo-Ni-Cu low alloy S.G. CAST IRON TYPE A.D.I. .... 54</p> <p><i>MELINTE ION, MIHAELA BALANESCU, NECULA HORIA, TANTAU ADRIAN DUMITRU:</i> The improving of the energetic regime of the electric arc furnaces, due to some technological modernizations ..... 56</p> <p><i>RODICA-MARIANA ION, DOINA BOROS, MIHAELA-LUCIA ION, IRINA DUMITRIU, FIERASCU RADU-CLAUDIU, RADOVICI CONSTANTIN, GINA FLOREA, CRISTIANA BERCU:</i> Combined spectral analysis (EDXRF, ICP-AES, XRD, FTIR) for characterization of bronze Roman Mirror ..... 61</p> <p><i>NEAGU CORNELIU, DUMITRESCU ANDREI:</i> Neural networks modelling of process parameters in honing of thermal engines' cylinders ..... 66</p> <p><i>VIZUREANU PETRICĂ, AGOP MARCEL, BOTEZ I. CASIAN, IOANNOU P.D., VASILICA M.:</i> Dendritic morphogenesis through the fractal theory ..... 79</p> <p><i>ANA-MARIA LAZĂR, CHAUMONT DENIS, SACIOTTI MARCO:</i> Cobalt nanoparticles. Obtaining, characterization and their utilization for TiO<sub>2</sub> nanostructures obtained by MOCVD ..... 84</p> <p><b>FINANCIAL ECONOMIC MANAGEMENT. ACCOUNTANCY IN METALLURGY..... 88 - 93</b></p> <p><i>ROXANA IONESCU:</i> Additional clauses that can be attached to the life insurances ..... 88</p> <p><i>VALENTINA ZAHARIA:</i> The Management functions and their role in the management process ..... 91</p> <p><b>FOSECO Turbostop system – reference list..... I-II</b></p> <p><b>New books, published by Romanian Metallurgical Foundation.....III-IV</b></p> |
|---|---|

### DATA BASES

E According to paragraph 2.6 of license agreement between EBSCO Publishing Inc. (U.S.A.) and FUNDAȚIA METALURGIA ROMÂNĂ (ROMÂNIA) the journals METALURGIA and METALURGIA INTERNATIONAL are included in EP Products, starting from July 1<sup>st</sup>, 2006.

E These journals are included on EBSCO's site: [www.ebscohost.com](http://www.ebscohost.com), chapter „Computers and Applied Sciences Complete”, positions 1026 and 1027.

E Starting from January 1<sup>st</sup>, 2007 the journal METALURGIA INTERNATIONAL is also in the SCOPUS database, belonging to ELSEVIER BIBLIOGRAPHIC DATABASES – Amsterdam (Netherlands).

E We inform our authors and readers that our magazine “METALURGIA INTERNATIONAL” is introduced starting from year 2005 in THOMSON SCIENTIFIC MASTER JOURNAL LIST, letter M, position 400. For next information please access [www.isinet.com](http://www.isinet.com) position <http://scientific.thomson.com/cgi-bin/trnslt/itresults.cgi>

We informed already CNCIS, which in the framework of evaluations to be done in the first half of 2008 will introduce our magazine in category A

E THE BRITISH LIBRARY – Londra (Anglia), starting from year 2008

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. The “METALURGIA INTERNATIONAL” magazine receives manuscripts of papers including basic scientific research and industrial research in the following fields: metallurgy, materials science and engineering and different relating processes.</li> <li>2. Original papers not previously publishing in any other journal, or not sent for publishing before, are accepted.</li> <li>3. After publication, the copyright is transferred to the publishing house.</li> <li>4. Every manuscript will be referred, their reports form the basis of the Editor's decision.</li> </ol> | <ol style="list-style-type: none"> <li>5. The manuscripts sent to the Editor will not returned to the author, even they are not published.</li> <li>6. The manuscripts will be sent to the following address:<br/> <b>METALURGIA INTERNATIONAL</b><br/>             83, Calea Grivitei, sector 1, Postal code 010705, postal office 12<br/>             Bucharest, Romania<br/>             Tel.: +(40)-021-310 71 38; +(40)-021-0722 665 071;<br/>             Fax: +(40)-021-310 71 38<br/>             E-mail: <a href="mailto:redactia@metalurgia.ro">redactia@metalurgia.ro</a>; See also web: <a href="http://www.metalurgia.ro">www.metalurgia.ro</a> </li> </ol> |
|--|--|

REDACTION

# ABSTRACT

## Metalurgia International 5/2008

SUSTAINABLE DEVELOPMENT .....5 - 14

**D.C.: 669.18.046**

**Key words:** ecology, electric arc furnace  
IOANA ADRIAN, NICOLAE AVRAM, BĂLESCU CEZAR:  
**Ecological elements of the electric arc furnace**  
Metalurgia International (vol. XIII), no.5, 2008, p. 5

*The Electric Arc Furnaces (EAFs) for making steels, as powerful energy aggregates, are naturally important polluting agents.*

*The paper presents a theoretical and experimental analysis of the polluting generating mechanisms for steel making in the EAF.*

*The scheme for the environment's polluting system through the EAF is designed and presented in this paper.*

*The ecological experimenting consisted of determining by specialized measures of the dust percentage in the evacuated gases from the EAF and of thereof gas pollutants.*

*From the point of view of reducing the impact on the environment, the main problem of the electric arc furnace (EAF) is the optimization of the powder collecting from the process gases, both from the furnace and from the work-area. This optimization is both for the work conditions improvement and for the following of the limits imposed by the work and environment protection legislation.*

*The paper deals with the best dependence between the aggregate's constructive, functional and technological factors, which are necessary for the furnace's ecologization and for its energetically-technologically performances increasing.*

**D.C.: 669.162.267**

CALEA GHEORGHE, CRISTINA ȘTEFAN, MARIA NICOLAE:  
Researches about the measures of the environment improvement  
Metalurgia International (vol. XIII), no.5, 2008, p. 10

*This material presents problems about the environmental pollution and the assessment measures for the improvement of this phenomenon environmentally harmful.*

MATERIALS SCIENCE RESEARCH AND  
DEVELOPMENT ..... 15 - 87

**D.C.: 669.162.267**

**Key words:** pre-reduced iron ores, iron sponge  
CONSTANTIN NICOLAE, DOBRESCU CRISTIAN, IOANA  
APOSTOLESCU, RALUCA PETRACHE, BUZDUGA MIRON:  
**Research regarding the physical and chemical characteristics of pre-reduced iron ores and the analysis of the possibilities of their use in the iron and steel elaborating process**  
Metalurgia International (vol. XIII), no.5, 2008, p.15

*Taking into consideration the complexity of the traditional iron and steel elaborating methods that demand the existence of ore preparation plants, cookery, etc. moreover the deficit of coking coals and iron scrap it is necessary to search new possibilities of modifying the existent technologies or replacing them by new methods.*

*One option regarding this way represents the use of sponge iron obtained by direct reduction of iron ores or prepared into the iron and steel elaborating process.*

*Considering the high materials and energy consumption and environment pollution in the traditional iron and steel elaborating methods our paper's aim is to analyze the opportunity and the possibilities of obtaining the iron and steel by non-conventional technologies.*

*Our paper presents the results obtained from direct reducing of iron ores and our conclusions resulted from statistic analysis of obtained data by correlating the initial characteristics of the ores and qualitative characteristics of the pre-reduced product.*

**Key words:** TiAlNb alloys; structural characteristics; plastic deformation; heat treatment

DOINA RĂDUCANU, COJOCARU V. DĂNUȚ, BUZAIANU A.,  
CINCA ION, DAN I., SUCIU M.: **Structural characteristics of processed Ti-6Al-7Nb alloy in ( $\alpha+\beta$ ) domain by plastic deformation and heat treatment**  
Metalurgia International (vol. XIII), no.5, 2008, p. 21

*This paper presents some scientific results referring to structural characteristics of a Ti-Al-Nb alloy, processed by plastic deformation and heat treatment. In order to investigate structural characteristics two different phase states were used, the "lower" temperature phase ( $\alpha+\beta$ ) (~ 930°C) processed by plastic deformation, using a deformation degree  $\epsilon = 35\%$  and same ( $\alpha+\beta$ ) phase processed by plastic deformation and heat treated.*

**D.C.: 621.771**

CAMELIA PINCA –BRETOTEAN, TIRIAN GELU OVIDIU, LUCIA  
VÎLCEANU: **The effects of the thermal fatigue upon the hot rolling mill cylinders**  
Metalurgia International (vol. XIII), no.5, 2008, p. 25

*In this paper the hot rolling mills cylinders is under study, and the symmetrical and asymmetrical field of temperature are to be established. In the same time, the following notions will be introduced: middle temperature, specific radius and specific unidimensional temperature. Also, the exponential curve type according to the rotation angle of the cylinders is established, following a thorough analysis of the hot rolling process. The temperature variation curves on the surface and the radial section of the rolls are determined experimentally, and particularly, the superficial layer of the calibres is studied. Using original mathematic equations established for the numerical calculus of the symmetrical and asymmetrical field of temperature, with experimental data that allow the study of evolution of these tensions and determining the conditions in which the thermal fatigue specific cracks appear. Applying the deformation energy theory, the equivalent tensions are determined, for which, initially, the resulting main tensions acting in the element of the rolls material, in three-dimensional coordinates, are calculated.*

*In this study are analysed the effects of thermal fatigue, phenomena which are produced in the hot rolling mills cylinders, the evolution of the thermal tension upon different steel and iron grades used in the production of the rolls, according to the exploitation durability, up to the point of thermal fatigue cracks. Also, we suggest solutions meant to diminish the tensions, to avoid thermal shocks, and the use of new and performing materials for manufacturing hot rolling mills cylinders.*

**D.C.: 669.14.018.8**

PĂDUREAN IOAN, NEDELICU DORIAN, ELVIRA PĂDUREAN,  
ARPAD FAY, TRUȘCULESCU MARIN: **Researches upon cavitation erosion resistance of martensitic stainless steel used for molding Kaplan and Francis turbines runner blades**  
Metalurgia International (vol. XIII), no.5, 2008, p.34

*The paper presents the researches carried on upon the cavitation erosion of Martensitic stainless steel GX4CrNi 13-4 (SR EN 10283/99) [16] used for manufacturing Kaplan and Francis runner blades turbines. The studied steel was subjected to a heat treatment consisting from a quenching and tempering at high temperature followed by gaseous nitration [12], [14], [15]. The results have been compared with those of the steel 40Cr10 with good but not excellent cavitation erosions and with the Martensitic steels T07CuMoMnNiCr165-Nb and T09CuMoMnNiCr185-Ti used for hydraulic turbines and also with the Austenitic steel GX5CrNi19-10 studied by the authors in a previous works. For comparisons have been used the characteristic cavitation erosion curves [1], [2] and it resulted that the steel GX4CrNi 13-4 has excellent cavitation erosion qualities [10], [11], [12].*

# ABSTRACT

## Metalurgia International 5/2008

**D.C.: 669.2./8**

**Key words:** alloys Al-Si, grain refinement, rapid solidification, nanostructure

VARGA BELA, ÉVA FAZAKAS, VARGA K.LAJOS: **Preparation of nanocrystalline  $Al_{100-x}Si_x$  ( $6 < x < 40$ ) based alloys by rapid solidification methods**

Metalurgia International (vol. XIII), no.5, 2008, p. 41

*The evolution of grain refinement was followed by applying different rapid solidification (RS) methods (melt spinning and vacuum sucking) and parameters for  $Al_{60}Si_{40}$  alloys. Dopings with Fe-P a nanostructured  $(Al_{60}Si_{40})_{92}Fe_8P_2$  alloy have been prepared at excellent high temperature stability. Optical microscopy and X-ray diffraction techniques were used for characterization of the micro- and nanostructure.*

**D.C.: 669.18.046**

**Key words:** silicon carbide nanoparticles, refractory, blast furnace, iron runner

BORDEI MARIAN, ANISOARA CIOCAN, FLORENTINA POTECAȘU, ALEXANDRU PETRICA: **Blast furnace iron lining runners in term of structural characterisation**

Metalurgia International (vol. XIII), no.5, 2008, p.45

*In the present paper the structural modifications that appear during the exploitation in the wear layer of the iron runner are presented. The refractory material examined is a ceramic composite from  $Al_2O_3$ - $SiO_2$ -SiC system. The high wear resistance (erosion, corrosion and thermal shock) is the result, the one hand of the touch state dispersion hardening (SiC in the ceramic matrix) and on the other hand of the forming a thin eutectic structure.*

*The reduced and noncommunicative porosity ensures the establishing of the properties, as a result of a technology of realization through shotcret and through thermal treatment that precedes the putting into operation.*

**D.C.: 621.74**

ARDELEAN MARIUS, HEPUȚ TEODOR, ERIKA ARDELEAN, ANA SOCALICI, LUCIA VILCEANU: **New methods and analysis functioning techniques for cooling bed tool of the profile laminators**

Metalurgia International (vol. XIII), no.5, 2008, p.48

*Regardless of the contemporary society evolution, the steel is and will remain the main material utilised in constructions and in many fields in the modern industry, and the output of superior quality finished products represents a target aimed at by the majority of the steel producers.*

*Besides the problems regarding in elaboration process and quality of steel semifinished product in the continuous casting process [1], in lamination of the steel process must be given a special attention to the cooling conditions of the laminates in order to avoid their deformation, especially the small profile laminates. The correct functioning of the cooling beds that handle these laminates is an aim that must be taken account of by both the technology engineer and the mechanical engineer.*

*In these circumstances, the cooling bed ensures the cooling of the warm laminate that came out from the last lamination room or from the thermal treatment oven, until it reaches the temperature of adjusting to cold. This temperature must correspond to the manufacturing and handling conditions in the technological line and it is usually between 60-100°C. Simultaneously the cooling bed serves for the transport of the laminates for adjusting and, in some constructions, it prevents the deformation due to thermal tensions, or straightens the curved laminates. The design of the cooling bed is made depending on the type of the laminated product, the dimensional and qualitative manufacturing programme and the space conditions.*

**D.C.: 669.131.622**

**Key words:** Materials Science, bainitic s.g. cast iron, heat treatment, mechanical properties

MILOSAN IOAN: **Some aspects about Mo-Ni-Cu low alloy S.G. CAST IRON TYPE A.D.I.**

Metalurgia International (vol. XIII), no.5, 2008, p.54

*The paper presented here belongs to the researches about the influence of the heat treatment's parameters over the HB, Rm, KC and A variation of a Mo-Ni-Cu S.G. Cast Iron obtained by heat treatment.*

**D.C.: 669.18.046**

**Key words:** energy efficiency, Electric Arc Furnace, foaming slag, mathematical model, melting programmes

MELINTE ION, MIHAELA BALANESCU, NECULA HORIA, TANTAU ADRIAN DUMITRU: **The improving of the energetic regime of the electric arc furnaces, due to some technological modernizations**

Metalurgia International (vol. XIII), no.5, 2008, p.56

*The paper presents a method for the improving of the energetic regime of the Electric Arc Furnaces (EAF) with small capacity (up to 10 tonnes), in the case when during the melting of the steel into the furnace, foaming slag is used. In this situation an increasing of the thermal efficiency is obtained, through the minimisation of the thermal losses through radiation to the walls and to the vault of the furnace, as a result of the arc covering by the foaming slag.*

*Instead of the furnaces with big capacity, which are using the best technologies for the drawing up and the energetic control of the steel melting, for the small furnaces (generally used in Small and Medium Size Enterprises), such technologies are rarely used. Therefore, in the paper a mathematical model and the due algorithm are presented. These tools are used for the melting programmes optimisation, in the case of small EAF, working with foaming slag.*

**Key words:** XRF; spectrometry; stainless steel.

RODICA-MARIANA ION, DOINA BOROS, MIHAELA-LUCIA ION, IRINA DUMITRIU, FIERASCU RADU-CLAUDIU, RADOVICI CONSTANTIN, GINA FLOREA, CRISTIANA BERCU: **Combined spectral analysis (EDXRF, ICP-AES, XRD, FTIR) for characterization of bronze Roman Mirror**

Metalurgia International (vol. XIII), no.5, 2008, p.61

*Archaeometallurgy is, to some extent, applied engineering in a discipline of anthropology. It describes the properties and production of metal objects from archaeological or at least historical contexts. The chemical and structural examination of the surface corrosion products grown on archaeological bronzes has been the subject of study for at least 170 years. During the last decades, scientists have made extensive use of different analytical methods to investigate the complex structure and the composition of the bronze corrosion products i.e., the patina and to find a relationship between this information, the environment in which they are formed and the micro-chemical structure of the alloys. This innovative approach has been used in order to gain further insight into the microchemical structure of the corrosion products as well as for selecting the cleaning and restoration methods.*

*By means of the combined use X-ray diffraction (XRD), Fourier-Transformed spectrometry (FTIR), energy dispersive X-ray fluorescence (EDXRF), corrosion products, i.e., the patina, grown on archaeological bronze artefacts used by Romans, have been studied. For all of the archaeological artefacts, the results show that via the innovative use of ICP-AES and EDXRF it is possible to obtain reliable and reproducible quantitative elemental composition depth profiles for the outermost corroded layers, which are briefly discussed in combination with the microchemical features FTIR and XRD.*

# ABSTRACT

## Metalurgia International 5/2008

**Key words:** honing process, workability, neural networks  
**NEAGU CORNELIU, DUMITRESCU ANDREI: Neural networks modelling of process parameters in honing of thermal engines' cylinders**

Metalurgia International (vol. XIII), no.5, 2008, p. 66

*The honing process was modelled by its workability functions. The research revealed that the workability is influenced by the characteristics of workpiece material, characteristics of honing tool, cutting parameters and machining time. An experimental programme was designed and performed to study the influence of the above parameters on the honing process. The data obtained from this experimental programme was used as an input for neural networks. A backpropagation neural network with three layers was designed. Afterwards, the neural network was trained with a large series of experimental data. The remaining data was used to test the neural network. The neural network was used to study the influence and the weight of manufacturing parameters (material's hardness, diamond concentration of abrasive layer, rotative speed of hone, reciprocating speed of hone, contact pressure of abrasive stone on workpiece and machining time) on surface quality (roughness, roundness deviation and cylindricity deviation).*

**D.C.: 537.311.3**

**VIZUREANU PETRICĂ, AGOP MARCEL, BOTEZ I. CASIAN, IOANNOU P.D. , VASILICA M.: Dendritic morphogenesis through the fractal theory**

Metalurgia International (vol. XIII), no.5, 2008, p. 79

*Using the scale relativity theory in the topological dimension  $D_T = 3$ , some properties of the dendritic 'field' are analyzed. In the one-dimensional differentiable case, the dendritic morphogenesis process is achieved by cnoidal oscillation modes of the speed field and an Oldfield's relation type is obtained. In the non-differentiable case, the fractal kink spontaneously breaks the vacuum symmetry by tunneling and generates coherent structures. Since all the properties of the speed field are transferred to the thermal one and the fractal potential acts as an energy accumulator, a micro-domain having the same supercooling degree (virtual crystallization germ) appears. The local coherence*

*of these structures generates a stable crystallization germ and the global one generates the dendrite (as a crystallization grain).*

**D.C.:669.2/.8**

**ANA-MARIA LAZĂR, CHAUMONT DENIS, SACIOTTI MARCO: Cobalt nanoparticles. Obtaining, characterization and their utilization for TiO<sub>2</sub> nanostructures obtained by MOCVD**

Metalurgia International (vol. XIII), no.5, 2008, p. 84

*In this paper they are presented the preliminary results made to distinguish a method for obtaining cobalt nanometer powders, in witch the synthesis is activated with microwaves. Also, there are presented the results of the DRX and MEB analyze of the obtained powders. Then, there are presented the preliminary results of the TiO<sub>2</sub> nanostructures growth on the silicium substratum by MOCVD. The catalyst utilized is the ferrocene Fe(C<sub>5</sub>H<sub>5</sub>)<sub>2</sub>. The precursor utilized for the TiO<sub>2</sub> obtaining is the titan isopropoxide Ti(OC<sub>3</sub>H<sub>7</sub>)<sub>4</sub>.*

**FINANCIAL ECONOMIC MANAGEMENT.**

**ACCOUNTANCY IN METALLURGY..... 88 - 93**

**Key words:** life insurances, additional clauses, contract, security, infirmity

**ROXANA IONESCU: Additional clauses that can be attached to the life insurances**

Metalurgia International (vol. XIII), no.5, 2008, p.88

*In this work, the author points out the importance of covering the infirmity risks, the accidental decease, the inflation, the increasing of the insured amount and the possibility of attaching them as insurances/additional clauses to the life insurances policies.*

**Key words:** forecast, prognosis, strategy, reconsideration

**VALENTINA ZAHARIA: The Management functions and their role in the management process**

Metalurgia International (vol. XIII), no.5, 2008, p.91

*There are presented the five functions of the management: forecast, organization, coordination, training and control – valuation*



**Romanian Metallurgical Foundation  
Scientific Publishing House**