XIX International Scientific Conference on Metallurgy: Technologies, Innovation, Quality (Metallurgy2015)

IOP Conference Series: Materials Science and Engineering Volume 150

Novokuznetsk, Russia 15 - 16 December 2015

ISBN: 978-1-5108-3102-5 ISSN: 1757-8981 Printed from e-media with permission by:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2015) by the Institute of Physics All rights reserved. The material featured in this book is subject to IOP copyright protection, unless otherwise indicated.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact the Institute of Physics at the address below.

Institute of Physics Dirac House, Temple Back Bristol BS1 6BE UK

Phone: 44 1 17 929 7481 Fax: 44 1 17 920 0979

techtracking@iop.org

Additional copies of this publication are available from:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571 USA Phone: 845-758-0400 Fax: 845-758-2633 Email: curran@proceedings.com Web: www.proceedings.com

Table of contents

Volume 150

XIX International Scientific Conference on Metallurgy: Technologies, Innovation, Quality (Metallurgy2015)

15–16 December 2015, Novokuznetsk, Russia

Accepted papers received: 7 September 2016 Published online: 26 September 2016

Preface

011001 OPEN ACCESS XIX International Scientific Conference on Metallurgy: Technologies, Innovation, Quality (Metallurgy2015)

011002 OPEN ACCESS Peer review statement

Papers

012001 OPEN ACCESS Analysis of current state and prospects of steel production development

E V Protopopov and S V Feyler 1

012002 OPEN ACCESS Analysis of the main trends in the development of rail production in Russia and abroad

A V Golovatenko, A A Umansky and V V Dorofeev9

012003 OPEN ACCESS A study on the production processes of granulated iron

O I Nokhrina, I D Rozhikhina and I E Khodosov.....15

012004 OPEN ACCESS Metallization of oxide-ore-containing wastes with the use of brown coal semicoke from Berezovsky deposit of the Kansk- Achinsk Basin

A E Anikin, G V Galevsky, E V Nozdrin, V V Rudneva and S G Galevsky.....21

012005 OPEN ACCESS Development of scientific and technological bases for application of brown coal semi coke in the technology of non- milled silicon carbide

A E Anikin, G V Galevsky, V V Rudneva, E V Nozdrin and S G Galevsky.....28

012006 OPEN ACCESS A study on reduction processes of elements in the system V₂O₅-Si

M A Golodova, I D Rozhihina, O I Nokhrina and I A Rybenko.....37

012007 OPEN ACCESS Theoretical foundations of ferrosilicium disintegration

N F Yakushevich, A A Maksimov, A Yu Pronakin and O A Polyakh.....46

012008 OPEN ACCESS Modern trends in improvement of steel heating technology in continuous furnaces

V I Timoshpolskiy, M V Temlyantsev and I A Trusova.....52

012009 OPEN ACCESS Development of converter operation technology using ironbearing concentrates and clinker-steel cakes

E V Protopopov, S V Feyler, A V Amelin and E P Chumov.....60

012010 OPEN ACCESS Automated information system for analysis and prediction of production situations in blast furnace plant

V V Lavrov and N A Spirin.....65

012011 OPEN ACCESS Information modeling system for blast furnace control

N A Spirin, L Y Gileva and V V Lavrov.....71

012012 OPEN ACCESS Mathematical model and software for control of commissioning blast furnace

N A Spirin, O P Onorin, K A Shchipanov and V V Lavrov.....78

012013 OPEN ACCESS Mathematical model of layered metallurgical furnaces and units

V S Shvydkiy, N A Spirin and V V Lavrov.....85

012014 OPEN ACCESS Mathematical modeling of non-stationary heat and mass transfer in disperse systems

L A Ermakova, S Y Krasnoperov and S N Kalashnikov.....104

012015 OPEN ACCESS Software for simulation of utilization schemes of secondary energy from the exhaust gases of metallurgical units

A A Olennikov and V P Tsymbal.....110

012016 OPEN ACCESS Thermodynamic modeling of restoring items converter vanadium slag

M A Golodova, I D Rogihina, O I Nohrina and I A Rybenko.....115

012017 OPEN ACCESS Simulation of heterogeneous flow and the problem of application of the Navier-Stokes equations

V P Tsymbal, P A Sechenov, A A Olennikov and A G Padalko.....121

012018 OPEN ACCESS Background and principles of self-organizing jet-emulsion metallurgical unit

V P Tsymbal, V I Kozhemyachenko, I A Rybenko, S P Mochalov, A G Padalko, S N Kalashnikov, S Yu Krasnoperov, L A Ermakova and A A Olennikov.....128

012019 OPEN ACCESS Study of dioxins formation in the basic oxygen furnace during organic waste disposal

S N Kuznetsov, E P Volynkina and E V Protopopov.....137

012020 OPEN ACCESS Study of the possibility of iron extraction from waste coal by magnetizing roasting

E P Volynkina, V N Zorya and V V Korovushkin.....144

012021 OPEN ACCESS Gazification of coal dust particles in the blast furnace tuyere apparatus

V S Shvydky, Yu G Yaroshenko, N A Spirin and V V Lavrov.....150

012022 OPEN ACCESS Development of heat-transfer circuits in the blast furnace

N A Spirin, Yu G Yaroshenko and V V Lavrov.....157

012023 OPEN ACCESS Types of greenhouse gas emissions in the production of cast iron and steel

V G Lisienko, Yu N Chesnokov, A V Lapteva and V Yu Noskov.....168

012024 OPEN ACCESS Modification of gray iron produced by induction melting with barium strontium

G Modzelevskaya, A V Feoktistov, I F Selyanin, A I Kutsenko and A A Kutsenko.....175

012025 OPEN ACCESS Regularities of bainitic steel deformation transition

V E Gromov, E N Nikitina, Yu F Ivanov and K V Aksenova.....182

012026 OPEN ACCESS Detection of cold cracks in the cast-steels by the methods of ultrasonic and eddy-current infrared thermography

A I Cheprasov, S V Knyazev, A A Usoltsev, A E Dolgopolov and R O Mamedov.....188

012027 OPEN ACCESS Vibration influence on structure and density of aluminum alloys

A A Usoltsev, S V Knyazev, A I Kutsenko, A E Dolgopolov and R O Mamedov.....193

012028 OPEN ACCESS Improvement of rolling modes of long length rails on the universal rail and structural steel mill "EVRAZ ZSMK"

A V Golovatenko, A A Umansky and V N Kadykov.....198

012029 OPEN ACCESS Development of mathematical models and methods for calculation of rail steel deformation resistance of various chemical composition

A A Umansky, A V Golovatenko, V N Kadykov and L V Dumova.....205

012030 OPEN ACCESS Rational chemical composition and heat treatment models of rails made from E76HF steel using the heat of rolling heating

E V Polevoy and M V Temlyantsev.....213

012031 OPEN ACCESS New materials for welding and surfacing

N A Kozyrev, G V Galevsky, R E Kryukov, D A Titova and V M Shurupov.....221

012032 OPEN ACCESS On the use of slag from silicomanganese production for welding flux manufacturing

N A Kozyrev, R E Kryukov, U I Lipatova and O E Kozyreva.....229

012033 OPEN ACCESS <u>A study on the properties of the deposited metal by flux cored wires 40GMFR and 40H3G2MF</u>

A I Gusev, N V Kibko, N A Kozyrev, M V Popova and I V Osetkovsky.....238

012034 OPEN ACCESS <u>A study on the production of titanium carbide nano-powder in the nanostate and its</u> <u>properties</u>

L S Shiryaeva, S V Rudneva, G V Galevsky and A K Garbuzova.....245

012035 OPEN ACCESS Evolution of dispersion of high temperature chromium compounds

L S Shiryaeva, I V Nozdrin, V V Rudneva and G V Galevsky.....251

012036 OPEN ACCESS Strain-stress simulation and comparison of different welding sequences during manufacturing of packing vacuum cover

Yanhu Wang, Xizhang Chen and Sergey Konovalov.....259

012037 OPEN ACCESS Effect of electron beam treatment on structural change in titanium alloy VT-0 at highcycle fatigue

S V Konovalov, I A Komissarova, D A Kosinov, Yu F Ivanov, O V Ivanova and V E Gromov.....267

012038 OPEN ACCESS Change of deformation characteristics and dislocation substructure of nonferrous metals under influence of magnetic field

D V Zagulyaev, S V Konovalov, V V Shlyarov, E A Anuchina, I A Komissarova and V E Gromov.....273

012039 OPEN ACCESS Automated system of control and diagnostics of cast-steel defects in the mass production

S V Knyazev, A A Usoltsev, D V Skopich, E A Fatyanova and A E Dolgopolov.....279

012040 OPEN ACCESS <u>A study on structure and tribological properties of the electroerosion coating Mo-Ni-Cu,</u> formed by the mixed method on copper

D A Romanov, E N Goncharova, V E Gromov and Yu F Ivanov.....284

012041 OPEN ACCESS Formation of the Increased Wear-Resistant Properties of Hardox 450 Steel by Deposited Coatings

S V Konovalov, V E Kormyshev, E V Kapralov, Y F Ivanov, O V Zavatski and V E Gromov.....291

012042 OPEN ACCESS Electro-Explosive Doping of VT6 Titanium Alloy Surface by Boron Carbide

T Yu Kobzareva, V E Gromov, Yu F Ivanov, E A Budovskkh and S V Konovalov.....296

012043 OPEN ACCESS <u>Plasma metallurgical production of nanocrystalline borides and carbides</u>

G V Galevsky, V V Rudneva, A N Cherepanov, S G Galevsky and K A Efimova.....302

012044 OPEN ACCESS Protective metal matrix coating with nanocomponents

G V Galevsky, V V Rudneva, A N Cherepanov, S G Galevsky and K A Efimova.....309