

2022 (Vol. 23)



FOUNDERS:

"Ore & Metals" Publishing house
Nosov Magnitogorsk State Technical University

PUBLISHER:

"Ore & Metals" Publishing house

Established in 2006.

The "CIS Iron and Steel Review" journal is registered in the Russian Federal Service for Supervision of Communications, Information Technology, and Mass Media for Compliance with the Law in Mass Communications and Cultural Heritage Protection (Certificate PI No. FS77-73962 dated 19.10.2018)

Trade mark and the title "CIS Iron and Steel Review" are exclusively property of "Ore and Metals" Publishing House

The official information edition of the Federal Curricular Union "Technologies of Materials"

EDITORIAL BOARD

Chief editor: **Tsirulnikov Evgeny**

Deputy Chief Editors: **Kosyrev Konstantin, Vorobiev Alexandr**

Members of Editorial Board: Belenky Anatoly (Russia), Bleck Wolfgang (Germany), Bobarikin Yuriy (Belarus), Boriskin Oleg (Russia), Butorina Irina (Russia), Chichenev Nikolay (Russia), Chukin Mikhail (Russia), Elanskiy Dmitriy (Russia), Galkin Sergey (Russia), Goli-Oglu Evgeny (Denmark), Gordon Yakov (Canada), Illarionov Ilya (Russia), Kaputkina Lyudmila (Russia), Kazakov Alexandr (Russia), Kolikov Alexandr (Russia), Kolokoltsev Valeriy (Russia), Korchunov Alexey (Russia), Kushnarev Alexey (Russia), Leushin Igor (Russia), Mazur Igor (Russia), Savenok Anatoliy (Belarus), Scheller Piotr (Germany), Serebryakov Andrey (Russia), Sultanguzin Ildar (Russia), Tkachenko Stanislav (Russia), Travyanov Andrey (Russia), Volynkina Ekaterina (Russia), Vydrin Alexandr (Russia), Yatsenko Elena (Russia), Zyuban Nikolay (Russia)

EDITORIAL STAFF

Responsible Secretary: **Rakhmanova Elena**

EDITORIAL ADDRESS

Actual address: Moscow, Leninskiy prospekt 6, bld. 2, office 617

Mailing address: P.O. Box No. 71, Moscow, 119049, Russia

Phone/fax: +7-495-638-4518, +7-495-955-0175

E-mail: chermet@rudmet.ru; tsirulnikov@rudmet.ru

Web-site: www.rudmet.ru

Computer design and make-up by "Izdatelstvo UMC UPI" JSC

Volume: 15.5 printer's sheets (124 pages)

Printed: 12.07.2022 by "Kancler" Printing house

Circulation: 40 copies. Open price

© Design and make-up. AO "Издательский дом "Руда и Металлы",
"CIS Iron & Steel Review", 2022

© Cover picture: Evgeny Tsirulnikov

All rights reserved. This publication or its parts may not be reproduced in any form without written permission of the publisher.

Reference to "CIS Iron and Steel Review" is strictly required in the case of any reproduction.

Advertisers are responsible for reliability of advertising information.

Authors are responsible for reliability of scientific and technical information.

"Реклама" note means that material is published as sponsored statement (advertisement).

IN SCOPUS SINCE 2014!

In 2014, the journal "CIS Iron and Steel Review" was included into the international bibliographic and abstract database Scopus, which is an instrument for tracking of scientific articles' citedness.

The Ministry of education and science of Russian Federation considers the Scopus database as a criterion of estimation of efficiency of activity of higher education institutes. The journal "CIS Iron and Steel Review" is located in the first quartile (Q1) of Scopus (Scimago version) since 2017.

ISSN 2072-0815



CONTENTS

Preparation of raw materials

- V. V. Lvov, T. N. Aleksandrova, V. B. Kuskov, A. E. Pelevin. Study of possibility of magnetic hydrocyclone use in concentration cycles of oxidized ferriferous quartzites 4

Ironmaking

- P. I. Chernousov, A. E. Karpalev, A. V. Kramar, V. O. Podusovskiy. Comprehensive index of compound blast furnace smelting 9

- E. P. Pototskiy, T. S. Lazareva. Investigation of factors affecting the safety of a blast furnace operation 15

Casting and Foundry

- N. I. Gabelchenko, A. A. Belov, N. A. Kidalov, S. R. Polyak. Use of experimental casting equipment for research of castings crystallized through individual cooling procedures 19

Rolling and other Metal Forming Processes

- V. M. Kolokoltsev, N. A. Feoktistov, A. S. Savinov, E. V. Skripkin. Development of new composition for sHSS steel used for hot rolling mill rolls at Magnitogorsk Iron and Steel Works 24

- A. B. Moller, O. N. Tulupov, S. A. Levandovskiy, D. A. Nazarov. Providing steel with an approximate application of the mechanical properties of wire rod 5.5-6.5 mm from sreel grades 70-75 based on a conventional twin of the Stelmor process 28

- I. K. Andrianov. Minimization of dies volume using uniform distribution of hollows in the conditions of multi-cycle fatigue dependence on temperature 33

- V. F. Danenko, L. M. Gurevich. On calculation of stress-strain state of steel closed ropes in extension and twisting. Part 2. Influence of torsion on the stress-strain state of closed rope 39

Tubemaking

- G. P. Zhigulev, M. M. Skripalenko, V. A. Fadeev, M. N. Skripalenko, V. N. Danilin. Modelling of the sheet forming while 3-roller bending process 45

- V. N. Shinkin. Analytical calculation of sheet curvature in four-roll mills at tubes production 50

Coatings application and Corrosion protection

- A. G. Sokolov, E. E. Bobylev. Features and regularities in formation of diffusion nickel-copper coatings on steels in the medium of low-melting liquid-metal solutions .. 56

- N. A. Serdiuk, E. I. Pryakhin, A. V. Sivenkov. Technological basis for the process of application of diffusion coatings in liquid metal melts with use of electric furnaces with air atmosphere 61

Metal Science and Metallography

- D. A. Gorlenko, D. V. Konstantinov, M. A. Polyakova, M. Dabalá. TRIP steels: the features of chemical composition and structure, prospects of application (overview) 67
- A. A. Akberdin, A. S. Kim, A. S. Orlov, R. B. Sultangaziev. Diagram of the phase composition of the Fe - Si - Al system and its isothermal sections 76
- N. A. Kozyrev, R. E. Kryukov, V. E. Gromov, Yu. A. Shlyarova. Structure, defect substructure and fracture surface of low-carbon alloy steel welds 81
- A. E. Balanovskiy, M. G. Shtaiger, V. V. Kondratyev, A. I. Karlina. Determination of rail steel structural elements via the method of atomic force microscopy. 86

Powder Metallurgy

- E. V. Ageev, E. V. Ageeva, A. Yu. Altukhov. Structure and properties of additive products manufactured from electroerosion powders 92

Refractory materials

- E. A. Sidorina, A. Z. Isagulov, I. D. Kashcheev, K. G. Zemlyanoy. Study of aluminosilicate refractories after operation in the presence of fluorine-containing wastes 98

Quality of Products

- A. V. Kudrya, E. A. Sokolovskaya, D. F. Kodirov, E. V. Bosov, G. V. Kotishevskiy. On necessity of taking into account statistical nature of the objects using Big Data in metallurgy 105

Power Engineering

- S. V. Kartavtsev, E. G. Neshporenko, S. V. Matveev. Primary diagnosis of energy efficiency in an integrated steel plant, based on intensive energy-saving methodology. Part 2 113

Ecology and Recycling

- S. V. Panchenko, M. I. Dli, M. V. Chernovalova, N. S. Kulyasov. Thermophysical processes in dry granulation of metallurgical slags. 119