

CROATIAN METALLURGICAL SOCIETY (CMS)
HRVATSKO METALURŠKO DRUŠTVO (HMD)

17th INTERNATIONAL / 17. MEĐUNARODNI

SYMPOSIUM OF CROATIAN METALLURGICAL SOCIETY
SIMPOZIJ HRVATSKOG METALURŠKOG DRUŠTVA

S H M D '2024

MATERIALS AND METALLURGY / MATERIJALI I METALURGIJA
BOOK OF ABSTRACTS / ZBORNİK SAŽETAKA

Obljetnice Hrvatskog metalurškog društva
Anniversaries of Croatian Metallurgical society

1952.-2024. HRVATSKO METALURŠKO DRUŠTVO / CROATIAN METALLURGICAL SOCIETY / 72 god./y

1962.-2024. ČASOPIS METALURGIJA / METALURGIJA JOURNAL / 62 god./y



ZAGREB, CROATIA, April 18 – 19, 2024
ZAGREB, HRVATSKA, 18. – 19. travanj 2024.

THE AIM OF SYMPOSIUM

The aim of this Symposium is to point out all the possibilities of the materials and achievements in metallurgy.

TOPICS OF THE SYMPOSIUM WERE:

Materials

- New Materials
- Refractory Materials
- The Development
- Applications
- Physical Metallurgy

Metallurgy

- Process Metallurgy and Foundry
- Plastic Processing of Metals and Alloys
- Technologies
- Energetics
- Ecology in Metallurgy
- Quality Assurance and Quality Management

17th International Symposium of Croatian Metallurgical Society „Materials and Metallurgy“ was held as a part of Anniversaries:

1952.–2024. HRVATSKO METALURŠKO DRUŠTVO / CROATIAN METALLURGICAL SOCIETY

1962.–2024. ČASOPIS METALURGIJA / METALURGIJA JOURNAL

„Countries Participating at the 17th International Symposium of Croatian Metallurgical Society“ – total 50 „Organizer“, „Co-organizer“, „Co-operation with organizations“, same as 16th symposium, Please see Metalurgija 62 (2023) 1, 8-10

ACCEPTED ABSTRACTS

Materials – Section „A“	45
Process Metallurgy – Section „B“	70
Plastic Processing – Section „C“	11
Metallurgy and Related Topics – Section „D“	43
Rejected Abstracts	55
TOTAL ABSTRACTS:	224

PATRONS (same as for 16th Symposium)

- World Steel Association (WSA)
- International Society of Steel Institutes (ISSI)
- European Steel Federation (ESF)
- European Steel Institute Confederation (ESIC)
- University of Slavonski Brod, Faculty of Mechanical Engineering, Croatia
- University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Croatia

NAPOMENA:

- Mnogi autori / koautori nisu se pridržavali zadanog oblika i dužine sažetaka referata. Znanstveni odbor je izveo usaglašavanje, te isprika ako postoje nedostaci. Moguće je i možebitni izostanak nekog sažetka. Sve Reklamacije se usvajaju do 30. ožujka 2024. god., posebice tisak, Metalurgija 63 (2024) 3.

NOTE:

- Many authors / co-authors have not observed the given form and length of abstracts of their reports. Scientific board has made adjustments, so we apologize if there are any faults. An abstract might be failing. All Protests will be accept till March 30, 2024, and after separately publish, Metalurgija 63 (2024) 3.

SCIENTIFIC COMMITTEE

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Dear Participants, Authors, Co-authors et al.,

Thirty years (1993-2023) have passed since foundation of International Symposiums of Croatian Metallurgical Society „Materials and Metallurgy“. First Symposium (September 15-17, 1993) was postponed due to war operations in Sisak, and subsequently held in Zagreb, February, 16-18, 1994. Till now total 16, Countries participating were about 50, over 70 differents Institutions, total 6 562 Abstracts of over 10 000 Authors and Co-authors.

Dear al., my thanks to You, because without You this Symposiums would have never come about.

Special thanks and compliments are to many Members of Committees Scientifics, Organizing, Honour Boards, Reviewers, Chairman of Sections etc.

I just hapen to be first amoving equals.

Leader of all Symposiums

Akad. I. Mamuzić, Prof.h.c.,dr.h.c.

Countries Participating at the 17th International Symposium of Croatian Metallurgical Society “Materials and Metallurgy”

1 Argentina	18 Greece	35 Portugal
2 Austria	19 Hungary	36 Romania
3 Belgium	20 India	37 Russia
4 Belarus	21 Indonesia	38 Saudi Arabia
5 Benelux	22 Iran	39 Serbia
6 Bosnia and Herzegovina	23 Italy	40 Singapore
7 Brazil	24 Japan	41 Slovakia
8 Bulgaria	25 Kazahstan	42 Slovenia
9 Chile	26 Korea	43 South Africa
10 China	27 Lithuania	44 Spain
11 Croatia	28 Macedonia	45 Sweden
12 Czech Republic	29 Malaysia	46 Thailand
13 England	30 Mexico	47 Turkey
14 Egypt	31 Montenegro	48 Ukraine
15 Finland	32 Netherlands	49 USA
16 France	33 Philippine	50 Vietnam
17 Germany	34 Poland	

All 17 Symposiums have been held:

- 1st Zagreb: 1994, February, 16-18 (88 lectures)
- 2nd Split: 1996, June, 20-22 (150 lectures)
- 3rd Šibenik: 1998, June, 25-27 (192 lectures)
- 4th Opatija: 2000, June, 25-29 (333 lectures)
- 5th Šibenik: 2002, June, 23-27 (375 lectures)
- 6th Šibenik: 2004, June, 20-24 (368 lectures)
- 7th Šibenik: 2006, June, 18-22 (475 lectures)
- 8th Šibenik: 2008, June, 22-26 (615 lectures)
- 9th Šibenik: 2010, June, 20-24 (541 lectures)
- 10th Šibenik: 2012, June, 17-21 (641 lectures)
- 11th Šibenik: 2014, June, 22-26 (689 lectures)
- 12th Šibenik: 2016, June, 19-23 (546 lectures)
- 13th Šibenik: 2018, June, 24-29 (561 lectures)
- 14th Šibenik: 2020, June, 21-26 (435 lectures)
- 15th Zagreb: 2022, March, 22-23 (527 lectures)
- 16th Zagreb: 2023, April, 21-22 (362 lectures)
- 17th Zagreb: 2024, April, 18-19 (224 lectures)

61. R.V. Usenko, V.F. Mazorchuk, R.R. Barkar, I. Mamuzić

Justification of the technology of melt processing in foundry ladles. Treatment of melts in ladles is an important technological operation that has several valid advantages. First, this technology allows accurate dosing of materials and melts, ensuring high quality products. Secondly, processing in ladles allows you to control the temperature, composition, which affects the structure and properties of the material. The treatment of melts in ladles is essential to support the production of high-quality parts and contributes to the productivity and efficiency of the casting process.

62. L.I. Solonenko, D.Yu. Yakymenko, O.P. Bilyi, I. Mamuzić

Cladding sand structuring in the manufacture of foundry molds based on frozen models. Clad sand structuring plays an important role in the production of casting molds from frozen models. This process helps ensure casting accuracy and quality. The sand is compressed around the model, forming a shape. The relief surface of the model is transferred to the mold, and this is critical for the production of parts with the necessary configurations. It is important that the structure is uniform and strong to ensure successful casting and product quality.

63. Z. Cui, H. Y. Long, R. Q. Gong, F. Y. Zhu, W. Z. Yan

Structure optimization of ladle rotary table mounting device. As a widely used equipment in continuous casting process, the installation process of ladle rotary table is complicated and requires many installation equipment. According to the practical engineering application, this paper takes the installation device as the research object, and optimizes the original structure of the installation device. SolidWorks software was used to model the overall structure of the installation device, and the established model was imported into Hypermesh for mesh division, and finally into ANSYS for finite element analysis to compare the stress and deformation of the structure before and after optimization. The results show that the stress of the optimized structure is reduced to some extent, and the practical application requirements are met.

64. P. Huo, Y. J. He, J. F. Chen

High temperature deformation constitutive model of GGG70L duction iron. In order to accurately describe the high temperature deformation behavior of GGG70L ductile iron, the thermal simulation experiments with deformation rate of $0,01\sim 10\text{ s}^{-1}$ were carried out at $800\sim 1100\text{ }^{\circ}\text{C}$ by Gleeble-1500D thermal simulation machine. The deformation behavior of GGG70L ductile iron was studied. The temperature compensated strain rate Zener-Hollomon parameter was introduced, and the constitutive model of GGG70L ductile iron was established based on the strain compensated Arrhenius model. The results show that the theoretical value of peak stress calculated by the constitutive model is in good agreement with the experimental results, and the correlation is 97,8 %, which can accurately describe the high temperature deformation behavior of GGG70L ductile iron.

65. V.M. Shevko, R.A. Uteyeva, A.D. Badikova

Electrothermal co-production of ferrosilicon, calcium carbide and gaseous phosphorus from the chilisay phosphorite. The article presents the results of studies on the use of the high-silicon phosphorites (51,8 % of $\text{Ca}_3(\text{PO}_4)_2$, 25,6 % of SiO_2) for the co-production of ferrosilicon, calcium carbide and gaseous phosphorus. The studies included the electric smelting a charge in an arc furnace and using the second-order rotatable designs. The conditions of producing FeSi45 ferrosilicon (51,2-54,2 % of coke, 12,5-18,4 % of steel shavings) and FeSi25 ferrosilicon (53-58 % of coke, 39,7-40 % of steel shavings) with extraction of 65-67,8 % of silicon into the alloy were determined. The second product of the process is technical calcium carbide with a capacity of 129-167 l/kg, in which from 44,8 to 64,1 % of calcium is extracted. At least 99,3 % of phosphorus during the electric smelting is sublimated.

66. M. J. Mvita, N.G. Zulu, B. Thethwayo, S. Makhmisa

Thermodynamic effects of temperature during roasting of chromite for sodium chromate salts formation. This paper aims to assess the potential effects of roasting temperature on the formation of sodium chromate ($\text{Na}_2\text{Cr}_2\text{O}_7$). To perform this task, chromite samples were complexed with NaCl at temperatures ranging from $900\text{ }^{\circ}\text{C}$ to $1200\text{ }^{\circ}\text{C}$ in the presence of excess oxygen. These experimental conditions were set and assessed based on the predicted phase transformations using Factstage as a prediction tool. The scanning electron microscopy and energy dispersive spectroscopy (SEM-EDS) have revealed the roasting behaviour of chromite to be governed by a fully reacted outside layer and an unreacted core. As per the x-ray diffraction (XRD) results, at lower temperature settings, mineral phases such as hematite and chromium oxide reported as an indication of predicted oxidation of chromite. The key results indicate that the addition of NaCl reduces the equilibrium temperature, thereby fully decomposing the stable and refractory spinel structure of chromite at $1200\text{ }^{\circ}\text{C}$.

67. M. Walkowicz, P. Osuch

The role of surface wettability of copper and its alloys CuSn6, CuZn37 in antimicrobial efficacy standardized tests. The spread of bacterial infections often occurs through indirect contact with infected individuals. Thus, surfaces with antimicrobial properties have gained prominence in healthcare and public spaces. Testing standards exist for assessing the antibacterial effectiveness of these materials, but they do not consider surface properties, particularly surface wettability during microbiological tests. An experiment was conducted to modify copper and its alloys' surfaces through chemical treatment, altering contact angles. The results revealed that contact angles significantly influence the contact area between droplets and test surfaces, as well as the evaporation time of droplets. These factors can ultimately impact the results of antimicrobial efficacy tests.

68. W.L. Fu, L.W. You

Influence of additional stress caused by mining subsidence on blast furnace in metallurgical mining area. Underground goaf in metallurgical mining area leads to surface subsidence and has destructive effect on blast furnace. This paper studies the influence of underground goaf on blast furnace. The overlying strata and surface subsidence due to the formed gob area after the underground mining led to a different degree of destruction to blast furnace. Hence, blast furnace was modeled to theoretically analyze the additional stress applied to blast furnace body and foundation when withstanding the surface deformation. On this basis, the anti-deformation structure was designed to analyze the influences of Class I - IN surface deformation on the setting of Blast furnace body unit

69. K. Akishev, K. Aryngazin, A. Tulegulov, M. Bayzharikova, Zh. Nurtai

Evaluation of the efficiency of the technological process for the production of building products with fillers from metallurgical slag. The article presents studies related to the practical use of metallurgical slags by Limited Liability Partnership “Casting”, Limited Liability Partnership “Kazakhstan Steel Production-steel” in the production of building products. The process of preparation and experiments to determine the strength of control samples, full-scale tests of building products are shown. The relevance of the study lies in the fact that the technological process of production of building products involves technogenic waste that cannot be used in the process of metal production, which makes it possible to improve the ecological background in the region, as well as promising opportunities for obtaining raw materials used as ingredients of concrete mixtures. The presented practical implementation of the automation of the process of adding fillers (technogenic raw materials) in the preparation of a concrete mix allows increasing the efficiency and productivity of the production of building products. The article will be useful to everyone who conducts research in the field of recycling of industrial waste from metallurgy, as well as commercial use.

70. L. X. Sun, L. L. Li

Mathematical modeling and intelligent optimization solution of gas allocation problem in iron and steel production. This paper studies gas allocation problem in the iron and steel production. Gas allocation problem is a multi-objective optimization problem with complex constraints. A gas allocation problem is mathematically modeled with high dimension, non-linear and complex constraint features. The intelligent optimization algorithms have certain advantages in solving such model. An improved Differential Evolution algorithm based on individual quality evaluation is proposed to solve the above model. The results show multiple gas allocation schemes are provided when all constraints are met, and all optimization objectives of some schemes are better than manual gas allocation scheme.