

15th International Conference on Industrial Manufacturing and Metallurgy

IOP Conference Series: Materials Science and Engineering
Volume 966

Online
18-19 June 2020

Editors:

Victor Goman
Maria Mironova

ISBN: 978-1-7138-4787-8
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.

This work is licensed under a Creative Commons Attribution 3.0 International Licence.
Licence details: <http://creativecommons.org/licenses/by/3.0/>.

No changes have been made to the content of these proceedings. There may be changes to pagination and minor adjustments for aesthetics.

Printed with permission by Curran Associates, Inc. (2022)

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

Preface	
Committees	
Peer review declaration	
The study of the relationship between stock value and financial performance of iron and steel enterprises using artificial intelligence techniques	1
<i>V V Potanin, O Yu Sidorov</i>	
Comparative evaluation of effectiveness indexes of column packings in benzol absorbers.....	7
<i>E V Nogovitsyna</i>	
Substantiation of parameters of underground geotechnology in the development of complex structural deposit of various grades of ores	13
<i>A M Mazhitov, P V Volkov</i>	
Counterflow step-type bulk material cooler	19
<i>A S Shishkin, S F Shishkin</i>	
Calculation of a closed grinding cycle in a jet mill with two classifiers.....	25
<i>D S Barakovskikh, S F Shishkin</i>	
Influence of liquid nitriding on the properties of the electric steel 10	31
<i>V A Korotkov, D V Isakov</i>	
Nickel sorption from solutions with high salt concentration	37
<i>O Yu Makovskaya, O B Kolmachikhina, V G Lobanov, S E Polygalov</i>	
Technology for carrying out hydraulic fracturing using a new material ‘nitinol’	43
<i>A E Verisokin, A P Yanukyan, D Yu Serdyukov, L G Zhulina</i>	
Analysis of single- and double-threaded rolling for production of grinding balls of alloy steel grades	48
<i>I Galimyanov</i>	
Study of possibility of cerium reduction from slags of CaO-SiO ₂ -Ce ₂ O ₃ -15%Al ₂ O ₃ -8%MgO system.....	54
<i>A A Babenko, L A Smirnov, A G Upolovnikova, R R Sharshdinov</i>	
Destruction electrospark deposits during Joule heating of base metal	60
<i>G E Trekin, O I Shevchenko</i>	
Effect of basicity and chromium oxide on the viscosity of boron-containing slags	66
<i>A A Babenko, R R Sharshdinov, A G Upolovnikova, A N Smetannikov, L Yu Mikhailova</i>	
The use of additional filler wire to solve the tandem GMAW issues	71
<i>I O Polevoy, A M Fiveyskii</i>	
Double-sided arc welding with multiple electrodes of vertical joints of steel tanks.....	77
<i>O I Filippov, V A Erofeev, S I Poloskov, A Yu Melnikov</i>	

Application of surfacing using consumable electrode with an additional filler wire to ensure the required operational properties of pipeline valves.....	83
<i>S S Poloskov, D S Buzorina, V A Erofeev</i>	
Influence of technological parameters on the vanadium valence form in slags.....	89
<i>A V Klimov</i>	
Technology for fixing mine workings with friction anchors of the SZA type with a new type of anticorrosive coating	95
<i>P V Volkov, R V Kulsaitov, A M Magitov</i>	
Kinetics of vanadium reduction from slags by solid carbon.....	100
<i>A V Klimov</i>	
Modelling of the thermal state and the melting loss of a graphite electrode in the conditions of the evaporative cooling in the arc furnace.....	105
<i>M V Bystrov, I M Yachikov, I V Portnova</i>	
Application of hydrohammers of heavy class in the development of marble deposits in mining operations	111
<i>I A Pytalev, D V Domozhirov, N V Ugolnikov, A A Prochorov</i>	
The microstructure and hardness of casting a solid brake disc after late graphitizing modification	117
<i>D A Boldyrev, R R Dema, O B Kalugina</i>	
Improving the production technology of drilling and blasting operations by blasting of high ledges.....	122
<i>N V Ugolnikov, D V Domozhirov, N G Karaulov, A A Prochorov</i>	
Microstructure of impurity phase inclusions in gray cast iron and their composition.....	128
<i>D A Boldyrev, R N Amirov, S P Nefed'ev</i>	
Influence of blast furnace slag type on physical and mechanical properties of Portland cement.....	133
<i>F L Kapustin, T S Balueva</i>	
Prospects for the use of peat in metallurgy.....	139
<i>T B Ykonovskaya, A I Zhigulskaya</i>	
Research on the influence of the strip tension on contact stress and cold rolling force with a strain-hardening.....	144
<i>K Ilin, G Baranov</i>	
The effect of enrichment on quartz sand properties	150
<i>L F Mufteeva, I A Pavlova, E P Farafontova</i>	
The use of technogenic raw materials to produce a high-alumina chamotte	155
<i>A A Getman, I A Pavlova, E P Farafontova</i>	
Nanofine spatial dissipative structures with azimuthal lattice curvation.....	159
<i>V B Malkov, O V Chemezov, V G Pushin, A V Malkov, B V Shulgin, O V Malkov</i>	
Phenomenon of relaxation of inhomogeneous elastic rotational curvature of the lattice of nanofine spatial dissipative structures of hexagonal selenium	164
<i>V B Malkov, O V Chemezov, V G Pushin, A V Malkov, B V Shulgin, O V Malkov</i>	
Thermal stability of hafnium bronze subjected to dynamic channel angular pressing	169
<i>A Stolbovsky, V Popov, E Popova, R Falahutdinov, S Murzinova, E Shorokhov</i>	

The use of regression models to describe the temperature coefficient values of linear expansion and technological temperatures of CaSO ₄ -KPO ₃ -Na ₂ B ₄ O ₇ low-melting glass system.....	174
<i>A Stolbovsky</i>	
Physico-mechanical properties of the sinter of various chemical composition	179
<i>S K Sibagatullin, A S Kharchenko, V I Sysoev, D N Gushin</i>	
The effect of wear-resistant coatings composition based on niobium nitride on the structural parameters, mechanical properties and efficiency of the cutting tool.....	185
<i>V P Tabakov, L V Khudobin, A V Chikhranov, Y A Dolzhenko</i>	
Research features of opening of refractory arsenopyrite concentrates by using low-temperature roasting	189
<i>N O Zvontsov, D A Rogozhnikov</i>	
Estimation of selective reduction of iron and phosphorus from manganese ores of different genesis	195
<i>N Y Kosdauletov, V E Roshchin</i>	
Obtaining of niobium-containing ferroalloys from the Russian ore raw materials.....	201
<i>V I Zhuchkov, O V Zayakin, L Yu Mikhailova</i>	
The problems of application of domestic ore raw materials in the production of ferroalloys	206
<i>V I Zhuckov, L I Leontiev, O V Zayakin, V Ya Dashevsky</i>	
Scaling resistance of deposited metal by flux-cored wire 30N8Kh6M3STYu.....	211
<i>E N Eremin, A S Losev, I A Ponomarev, S A Borodikhin, A E Matalasova</i>	
Method analysis of surveying of mineral storages in open-pit mining	217
<i>E A Romanko, D V Domozhirov, O S Kolesatova, N V Litvinenko</i>	
Influence of technological depressurization on the operation of a cascade pneumatic separator.....	221
<i>V B Ponomarev, I P Fesun</i>	
Simulation of patterns of crystallizing ingot macrostructure formation	227
<i>O Yu Sidorov</i>	
Methodology of designing an air cascade separator.....	233
<i>V B Ponomarev, A S Shishkin</i>	
Investigation of structure and properties of low alloy steel obtained by wire arc additive manufacturing under various fluxes	238
<i>G E Trekin</i>	
Synthetic raw materials - possibility to increase refractory materials resistance.....	244
<i>K G Zemlyanoi, A R Khafizova</i>	
A development of computer vision elements for processing the results of tensile tests of specimens and building diagrams of ultimate plasticity	248
<i>M V Erpalov</i>	
The possibility evaluation of zinc sulphate forms extraction from sludge of PJSC EVRAZ NTMK with following metalloflux obtaining	254
<i>O Yu Sheshukov, M A Mikheenkov, I V Nekrasov, D K Egiazaryan</i>	
Reducing the carbonitride formation risk with increasing titanium dioxide content in the blast furnaces charge of JSC EVRAZ NTMK	258
<i>O Yu Sheshukov, M A Mikheenkov, I V Nekrasov, D K Egiazaryan</i>	

The effect of thermoplastic processing on the structure and mechanical properties of metastable austenitic steel	263
<i>N N Ozerets</i>	
Effect of frictional treatment with a dense cubic boron nitride indenter on the micromechanical properties of the NiCrBSi–Cr ₃ C ₂ coating	269
<i>N N Soboleva, A V Makarov, E P Nikolaeva, P A Skorynina, I Yu Malygina</i>	
Destruction of cement stone modified with a plasticizer and a nanoscale aluminum oxide.....	275
<i>E S Gerasimova, E D Trestsova</i>	
Utilization of final tailings concentration of titano-magnetite ores in Portland cement production	280
<i>F L Kapustin, N N Bashkatov</i>	
Utilization of ferrochrome slag in concrete production.....	286
<i>N N Bashkatov</i>	
Decoding variant for dilatometric measurements of metal samples heating and cooling.....	291
<i>S B Mikhailov, V A Sharapova, N A Mikhailova, A E Karellova</i>	
The effect of elastic deformation on the minor hysteresis loops of low carbon steel.....	297
<i>A N Mushnikov, E S Gorkunov, S M Zadvorkin, L S Goruleva, K D Kryucheva</i>	
Analysis of the influence of the parameters of the power supply network on the operating modes of the electric drives of the stands of the hot rolling mill 1700 of ArcelorMittal Temirtau JSC	302
<i>I V Breido, V M Druzhinin</i>	
Optimization of the ion-plasma nitriding of structural steel.....	308
<i>V R Baraz, E A Yurchenkov, E A Ishina</i>	
Technologies for remote lidar sensing of the surface to detect low concentrations of hydrocarbons in Siberia and the far north	313
<i>S L Leshchenko</i>	
Iron and steel industry of Russia in the XXI century	319
<i>S V Dokuchaev</i>	
Resource-saving potential of brick scrap from demolition of buildings.....	324
<i>I K Domanskaya</i>	
Study of the main metallurgical characteristics of iron ore raw materials (sinter and pellets)	329
<i>G Yu Vitkina, A N Dmitriev, R V Alektorov</i>	
Improvement in vanadium-containing titanomagnetite processing technology	335
<i>A V Kushnarev, K V Mironov, S A Zagainov, A A Forshev</i>	
Plasma hardening of corrosion-resistant steel	341
<i>M V Mironova</i>	
Graphite flake cast iron surface hardening	346
<i>M V Mironova</i>	
Evolution of the structure of precipitation-hardening steel during heat treatment	351
<i>E N Safonov</i>	
Research of features of structure formation in case of surface steel hardening.....	356
<i>E N Safonov</i>	

Sulfur partition by process stages of metallurgical production of JSC EVRAZ NTMK	362
<i>M V Savylyev, O Yu Sheshukov, A A Metelkin, O I Shevchenko, A S Tkachev, S V Shmakov</i>	
Calculation of sulfur removal in ladle furnace unit by means of ionic theory of slags	368
<i>M V Savylyev, O Yu Sheshukov, A A Metelkin, O I Shevchenko, D K Egiazar'yan</i>	
Research into in-service deterioration of ball-rolling rolls	374
<i>V Ju Rubcov, O I Shevchenko, A S Spirina, N A Pankova</i>	
Development of new roll pass designs for ball-rolling rolls with continuously variable parameters	380
<i>V Ju Rubcov, O I Shevchenko</i>	
Ultrasound effect on electrospark cementation process.....	386
<i>O I Shevchenko</i>	
Raising of energy efficiency of thermal performance of layered metallurgical units using layered type of natural gas combustion.....	392
<i>V I Matyukhin, A V Matyukhina, V A Dudko</i>	
Use of temporary gas flow to improve the efficiency of metallurgical units operation.....	398
<i>V I Matyukhin, A V Matyukhina, S Ya Zhuravlyov, N V Yamshanova</i>	
Development of radial-shear rolling mill special stands for continuous cast billets deformation	404
<i>R V Iskhakov, Yu V Gamin, M V Kadach, A S Budnikov</i>	
Determination of cutting forces based on DMG MORI CTX300 ecoline CNC lathe drive power data	410
<i>A P Starostin, D M Elkind</i>	
Development of the identifier system of indicators for improving the information potential of the holding.....	414
<i>E V Dolzhenkova, L V Iurieva</i>	
Ejector jet mill with external pressure	420
<i>D S Barakovskikh, S F Shishkin</i>	
Development of tool selection process for milling of pocket features	426
<i>T A Gordeeva, S S Kugaevskii, A P Starostin</i>	
Development of super-professional competencies of the production personnel in the context of university supplementary education programs	432
<i>Yu G Myslyakova, M V Kurashova</i>	
To the issue of transformation of ‘old industrial area’ geobrand through example of Sverdlovsk Region	437
<i>Yu G Myslyakova, M V Kurashova, M M Shcherbinin</i>	
Role of management of industrial enterprises in formation of labor migration trend in region	443
<i>M V Kurashova, Ye A Nadeina, Yu G Myslyakova</i>	
Difficulties of succession pipeline in large industrial enterprises of Nizhny Tagil in studies of tendencies of competitiveness of higher technical education	448
<i>M M Shcherbinin, V V Potanin, S E Chetverikov</i>	
Development of algorithm for excavation control.....	454
<i>O A Lukashuk, K Y Letnev, A P Komissarov</i>	

Informative modeling of subjective reality for intellectual anthropomorphic robots	458
<i>A G Dolganov, K Y Letnev</i>	
Arranging mining machinery systems in a single classification by the types of raw peat being extracted	464
<i>D R Iakupov, S L Ivanov, P V Ivanova, E K Permyakova</i>	
Reconditioning and hardening of mining equipment hydraulic cylinder working surfaces by using of double-electrode cladding	469
<i>S I Zverev, A M Fiveyskii</i>	
Patterns of form error inheritance during machining.....	473
<i>E V Pegashkina</i>	
The study of the influence of deviations of the arc energy parameters on the defects formation during automatic welding of pipelines	478
<i>A E Filyakov, M A Sholokhov, S I Poloskov, A Yu Melnikov</i>	
Application of double electrode welding as the way to increase welding productivity of fillet welds of bridge structures	484
<i>A A Mosin, M A Sholokhov, D S Buzorina</i>	
Evaluation of the resulting quality level index for interregional passenger automobile transport.....	490
<i>V V Epifanov, M Y Obshivalkin, K A Generalova (Lukon'kina)</i>	
Organizational factors for manufacturing defects reduction in small batch production	496
<i>I V Ershova, S G Baranchikova, E V Cherepanova, N N Chistyakov</i>	
Modern concept analysis of failure modes and consequences for quality assurance of products and processes.....	500
<i>E V Kalinin, L L Kalinina, O S Norkina</i>	
Advanced standard operating procedures for survey of buildings and structures of metallurgical production.....	505
<i>M S Kuznetsov, V G Dubinina, Yu V Patrushev</i>	
Instrument of the work breakdown accounting in the high-tech production	511
<i>O O Podoliak, Yu N Markova, T A Mineeva, N A Kuznetcova</i>	
Comparative analysis of cutting fluids	517
<i>I V Ershova, N E Kalinina, E V Cherepanova, D F Fayskhanov</i>	
Problem of model usage in mechanical engineering	522
<i>V F Pegashkin, N U Ignatova</i>	
Marketing aspect in the ‘Value Engineering’ in the new products development of machine-building enterprises.....	527
<i>A D Murukina, L M Tipner, M A Prilutskaya, N A Kalinina</i>	
Utilization aspects in a life cycle contract (the example of public transport in Russia)	533
<i>N A Amosov, E Y Kuznetsova, M A Prilutskaya, G R Kukushkina</i>	
Upgrading of induction motors with energy efficiency enhancement at the electrical repair shops and sites of the running industrial companies.....	539
<i>R G Mugalimov, A R Mugalimova, R A Zakirova</i>	

Processes in spark electric discharge in air, nitrogen and oxygen.....	545
<i>I M Piskarev, N A Aristova</i>	
Determination of the reduction coefficients in a continuous finishing group of stands in a hot rolling mill using artificial neural network.....	550
<i>O R Latypov, S I Platov, R R Dema, N V Urtsev</i>	
The research on the levelling process of thick slabs based on the electric motor parameters monitoring.....	554
<i>S Yu Belyaev, A A Fedulov, A S Alexandrova, E Yu Raskatov, T V Meshchaninova</i>	
Multi-criteria model for the development of industrial logistics	560
<i>A N Rakhmangulov, S N Kornilov, D V Aleksandrin, N O Shevkunov</i>	
Research and educational network of ground stations for receiving and processing information from educational satellites	566
<i>A A Spiridonov, V A Saechnikov, D V Ushakov, A G Kezik, V E Cherny, A P Verstakovskaya, V E Evchik</i>	
Temperature calculation for linear induction motor in transport application with multiphysics approach	572
<i>F N Sarapulov, V Goman, G E Trekin</i>	
Research in Autodesk Inventor weldment performance cultivator frame	578
<i>V V Telegin, I V Telegin</i>	
Synchronous reluctance machines: performance evaluation with and without ferrite magnets	583
<i>Mohamed N Ibrahim, Kotb B Tawfiq, E M Rashad, Peter Sergeant</i>	
Development of the temperature prediction algorithm for smart thermostat.....	589
<i>S I Korolev, R M Muhtdinov, O Yu Sidorov, V Goman</i>	
Comparison of minimum energy consumption indicators for electric motors powered directly from the mains at part loads	594
<i>V Goman</i>	
Sensitivity of robust systems controlling first order objects.....	600
<i>M A Volkov, D V Isakov</i>	
Research of a bi-directional DC-DC converter integrated in electric car power installation.....	606
<i>K H Gulyamov, B N Sharifov, A H Ghulomzoda, M Kh Safaraliev, R M Yunusov</i>	
Estimation of the operational characteristics and determination parameters of the vertical radial-axial hydraulic turbine type 400	612
<i>A A Gulakhmadov, S Sh Qurbanalizoda, Z V Kobuliev, B N Ghoziev</i>	
Mathematical modelling of mutual electromagnetic influences of related power transmission lines in a transition process mode	618
<i>S M Asanova, S M Suerkulov, M Kh Safaraliev, D U Asanova, R S Milutin</i>	
Method for designing drop-of-wire recognition systems on sections of undistorted two-wire power transmission lines	624
<i>S M Asanova, J S Ahyoev, N Askarbek, S M Suerkulov, D U Asanova, M Kh Safaraliev</i>	
Automation of movement control for modern main tank T-90	630
<i>M A Badrtdinov, D V Yudincev</i>	

Using of polymeric materials to defeat of lightly armored and easily vulnerable targets. Theory and experiments	635
<i>E A Khmelnikov, K V Smagin, T E Zavodova</i>	
Developing manufacturing execution system with predictive analysis	641
<i>V V Potekhin, AH Bahrami, B Katalinić</i>	
Epistemic responsibility of industrial enterprise engineer.....	647
<i>N U Ignatova</i>	
The additive technology to obtain a three-dimensional model of the 81Cu-19Ni alloy	653
<i>V R Baraz, S S Gerasimov, I A Gruzdeva, V P Shveikin, A V Chemesova, A O Ovchinnikova, I A Veretennikova</i>	
Tribological tests of the improved piston mechanism of the axial piston hydraulic machine	658
<i>S Stazhkov, A Kuzmin, V Elchinskiy, N Yakovenko</i>	
Review of the features of augmented reality application in the training of operators and maintenance staff.....	663
<i>S V Byvaltsev</i>	
Multi-criteria optimization of metal pressure processes using experiment planning methods	668
<i>S V Byvaltsev</i>	
Increase in linear motion steadiness of tractor-trailers using stabilizing towing couplers.....	674
<i>Y N Stroganov, E M Pampura</i>	
Study of the influence of the design of the turning tool on the removal of thermal energy from the cutting zone	680
<i>Y L Liberman, S V Lukinskikh, A V Smirnov</i>	
Using of polymeric materials to defeat of lightly armored and easily vulnerable targets. Mathematical modeling	686
<i>E A Khmelnikov, K V Smagin, T E Zavodova</i>	
Deep drawing failure modes.....	692
<i>A V Nezamaev, V V Karzhavin</i>	
Foundry production digitalization	696
<i>V M Gruzman</i>	
Interactional experience with the employer during a selection of educational content in a single-industry town	702
<i>R A Karellova</i>	
Possibilities of an artificial neural network use to control oxygen consumption in a converter shop	706
<i>R A Karellova</i>	
Possibilities of information technologies application to production problems solving by math modeling methods	711
<i>V M Gruzman</i>	
Investigation of skew piercing and upsetting effect on wheel steel mechanical properties.....	715
<i>A V Fomin, V P Romanenko, A N Nikulin, A A Sevastjyanov</i>	
Corporate culture as one of the key factors of effective industrial enterprise development	719
<i>E A Putilova, A V Shutaleva</i>	

Automated tool support system of a large machine-building enterprise	724
<i>A Bogoyavlensky, A Sirotyuk</i>	
Influence of thermal oxidation on the properties of titanium alloys.....	730
<i>V I Golubev, V V Medison, D S Pastukhov, V F Pegashkin</i>	
The use of homomorphic image processing to analyze coke grading	736
<i>V N Krouglov, A G Gruh, A L Gapak, I Khurelchuluun</i>	
Optimization of roll calibration for flange shape rolling. Groove space	742
<i>D L Shvarts, A M Mikhaylenko, E I Ustinova</i>	
Application of laser interferometry to analyze cutting tool state during machining.....	748
<i>I A Efimovich, I S Zolotukhin</i>	
Adapting standard maintenance approaches for mining excavators to actual operating condition	755
<i>D A Shibanov, S L Ivanov, K A Safronchuk, V I Knyazkina</i>	
Optimization of alternate profile component part machining.....	761
<i>L V Borshova, V F Pegashkin</i>	

Author Index