



FACULTY OF ELECTRICAL
ENGINEERING
UNIVERSITY
OF WEST BOHEMIA

ČKET

PROCEEDING

OF

UIE 2021

XIX International UIE Congress on Evolution and
New Trends in Electrothermal Processes

Congress is supported by



ampere europe asc.

www.ampereeurope.org



Organizing Committee

Prof. Ivo Doležel, Chairman

Prof. Jiří Kožený, Chairman

Assoc. Prof. Václav Kotlan, Local Organizer

Assoc. Prof. David Rot, Local Organizer

Dr. Lenka Šroubová, Secretariat

Faculty of Electrical Engineering, University of West Bohemia, Czech Republic

UIE 2021 - Evolution and new trends in electrothermal processes

ISBN 978-80-261-0930-3

Industrial partners presentation

Václav Pavlovec, CEO, JUNKER Industrial Equipment s.r.o., OTTO JUNKER – GROUP
Transistor Technology for Induction Melting Furnaces

Stanislav Němeček, CEO, RAPTECH s.r.o.
Benefits and Properties of Tools Processed by Laser Beam

Invited lectures

Jon Binner, Matthew Porter, Roger Morell, Petra Kumi and Vadim Yakovlev	
<i>Computational Characterization of Microwave Processing of SiCf/SiC Composites</i>	13
Egbert Baake and Bernard Nacke	
<i>Recent developments and future trends in Electrotechnologies</i>	15

List of congress papers

Valters Dzelme, Andris Jakovics and Egbert Baake <i>Liquid metal layer dynamics in transverse alternating magnetic field</i>	17
Imants Kaldre and Andris Bojarevics <i>Directional solidification of metallic alloys and composites under electromagnetic interaction</i>	19
Reinis Baranovskis, Didzis Berenis, Ilmars Grants, Andris Bojarevics and Toms Beinerts <i>New contactless aluminum degassing system - GaInSn model experiments with a numerical study</i>	21
Yuliya Pleshivtseva, Ilya Levin, Bernard Nacke, Martin Ennen and Alexander Nikanorov <i>Time-Optimal Feedback System with Identifier to Control Induction Heating Process</i>	23
Alexandr Ivanov, Vladimir Bukanin and Alexei Zenkov <i>Simulation Problems of Internal Inductors</i>	25
Alexandr Ivanov, Vladimir Bukanin, Alexei Zenkov, Valentin Vologdin and Vladislav Vologdin <i>A New Approach to Induction Heating Control</i>	27
Sean Muyskens and Robert Goldstein <i>Physical Simulation of Soft Magnetic Composite Impeder Performance for use in Induction Tube Welding Systems</i>	29
Ulrich Lüdtke and Andreas Löhllein <i>Temperature and flow distribution of liquid metal fin in refractory of induction crucible furnaces</i>	31
Mihails Birjukovs, Pavel Trtik, Anders Kaestner, Jevgenijs Telicko, Jan Hovind, Dariusz Jakub Gawryluk, Imants Bucenieks, Knud Thomsen and Andris Jakovics <i>Dynamic Neutron Imaging of Argon Bubble Flow in Liquid Gallium in Horizontal or Vertical Magnetic Field</i>	33
Patrick Rochala, Alexander Fröhlich, Martin Kroll and Verena Kräusel <i>A inductive joining technology for production of hybrid material composites</i>	35
Pablo Guillén, Héctor Sarnago, Óscar Lucía and José Miguel Burdío <i>Efficiency-Oriented Comparison of Modulation Strategies of a Multi-Output ZVS Resonant Inverter for Domestic Induction Heating</i>	37
Alexander Nikanorov, Yulia Pleshivtseva, Anton Popov, Marco Baldan and Bernard Nacke <i>Optimal programmed control of mass induction heating with guaranteed quality</i>	39
Mario Perez-Tarragona, Héctor Sarnago, Óscar Lucía and José M. Burdío <i>PFC Rectifier for High Power Quality and High Efficiency Domestic Induction Heating Appliances</i>	41

Martin Kroll, Wladimir Ebel, Peter Birnbaum, Jonas Gruner and Verena Kräusel	
<i>Electro-thermo-mechanical simulation of the longitudinal HFI-welding process of carbon steel tubes</i>	43
Sergej Belik	
<i>Development of high-performance air heater based on an inductively heated packed bed</i>	45
Amar Al-Obaidi, Martin Kroll and Verena Kräusel	
<i>FEM Simulation of Hot Single Point Incremental Forming Assisted by Induction Heating</i>	47
Mihails Birjukovs, Juris Vencels, Juhani Kataja and Peter Raback	
<i>Microwave Heating of Water in a Rectangular Waveguide: Validating EOF-Library Against COMSOL Multiphysics and Existing Data</i>	49
Nikolay Khrenkov	
<i>Load capacity of cables insulated materials of high thermal conductivity</i>	51
Bernard Nacke and Marco Baldan	
<i>Induction tempering of surface hardened components</i>	53
Jan Hrbek, Bence Mészáros, Mykhaylo Paukov and Martin Kudláč	
<i>Density of the System Al₂O₃-ZrO₂ in a Liquid Phase</i>	55
Jerzy Barglik, Adrian Smagór and Albert Smalcerz	
<i>Electrical Efficiency of Induction Contour Hardening Systems</i>	57
Guillaume Wasselynck, Huu-Kien Bui, Antoine Pierquin, Didier Trichet, Gérard Berthiau, Banda Kane, Javad Fouladagar and Abdoulaye Ba	
<i>Welding of Carbon Fibers Composite by Induction Heating</i>	59
Martin Ennen, Egbert Baake and Igor Niedzwiecki	
<i>Tailored Heating Of Billets For Hot Forming Using An Induction Heating Approach</i>	61
Mattia Guglielmi, Marco Baldan, Egbert Baake and Martin Schulze	
<i>Influence of Double-Frequency Lorentz Force Component in Modeling Electromagnetic Stirring of Molten Metals</i>	63
Igor Sokolov, Evgeniy Shvydkiy and Gennady Losev	
<i>Liquid metal flow generating by unsymmetric traveling magnetic field</i>	65
Sergejs Pavlovs, Andris Jakovics and Alexander Chudnovsky	
<i>Melt Electrovortex Flow in DC EAF Model with Two Bottom Electrodes in Axial Magnetic Field</i>	67
Matteo Lazzarin, Michele Forzan and Fabrizio Dughiero	
<i>Thermal behaviour of synthetic countertop used as cooker surface over induction hobs</i>	69

Sergio Lupi, Michele Forzan, Paolo Di Barba, Maria Evelina Mognaschi and Elisabetta Sieni	
<i>Optimal Synthesis of Dual Frequency Transverse Flux Induction Heating of Metal Strips</i>	71
Maxim Khatsayuk, Viktor Demidovich and Viktor Timofeev	
<i>The destruction model of cylindrical billet's hard shell during heating and melting by internal heat sources</i>	73
Stefan Schubotz	
<i>Research of multicentric ring coils in comparison to classic ring coils</i>	75
Alexander Antipin and Vasiliy Frizen	
<i>Investigation of the induction heating spherical bodies dispersed in the continuous load inductor stove</i>	77
Yuriy Perevalov and Victor Demidovich	
<i>Induction heat treatment of large rolls with two independent power sources</i>	79
Jonas Kimme, Josephine Zeisig, Alexander Fröhlich and Verena Kräusel	
<i>Technology development for manual laser cladding of high-alloy tool steels with simultaneous inductive preheating for crack prevention</i>	81
Ervīns Blumbergs, Janis Freibergs, Eriks Platacis, Mihails Majorovs and Vera Serga	
<i>Model experiments using slag during CdO recovery</i>	83
Patrick Rochala, Christian Hofmann, Martin Kroll, Maik Wiemer and Verena Kräusel	
<i>Chip-level bonding for microelectronic components by induction sintering of micro structured Ag particles</i>	85
Yuriy Perevalov, Victor Demidovich and Ivan Vegera	
<i>Advanced Induction Heat Treatment Systems of Pipes</i>	87
Vasiliy Frizen, Ivan Smolyanov, Fedor Tarasov and Salavat Fatkullin	
<i>Refined Model of Induction Heater Taken into Account Static Characteristics of Inverter</i>	89
Koen Van Reusel	
<i>Exposure to electromagnetic fields produced by industrial processes</i>	91
Francois Bay, Jesus Oswaldo Garcia, Jose Alves and Julien Barlier	
<i>Error analysis in finite element modelling of induction heating processes</i>	93
Ivan Smolyanov, Evgeny Shmakov and Juris Vencels	
<i>Numerical Approaches to Analyzing of MHD Processes Occuring to Induction Pump</i>	95
Alexander Lepeshkin, Alexander Kuvaldin and Stepan Lepeshkin	
<i>Investigation of Heating of Rotating Disks in an Electromagnetic Field Using Strong Permanent Magnets</i>	97

Evgeniy Shmakov, Ivan Smolyanov and Juris Vencels	
<i>Calculation Fluid Dynamic of Induction Pump Using Open Source Software</i>	99
Marina Rashevskaya, German Lipinskiy and Alexey Kulikov	
<i>Applicability of calculation methods of minimum and maximum short circuit currents in grid with voltage up to 1 kV</i>	101
Tareq Eddir, Robert Goldstein and Robert Haun	
<i>Investigating the Benefit of Soft Magnetic Composite Inserts on Energy Efficiency in Cold Wall Billet Casters Using Computer Simulation</i>	103
Pablo García Michelena, Xabier Chamorro Sanchez, Emilio Ruiz Reina and Nuria Herrero Dorca	
<i>Multiphysical modelling and validation of VIM for Inconel 718 heating and melting</i>	105
Andrey Zhurkin, Sergey Nekhamin, Michael Pogrebisskiy and Irina Martynova	
<i>AC arc electrical load model for new power supply analysis</i>	107
Eduard Vinter, Mikhail Pervukhin and Viktor Timofeev	
<i>Numerical simulation of conduction refining of molten aluminum in the casting launder</i>	109
Malvine Strakova, Vadims Geza, Mihails Scepanskis and Alvis Eimuss	
<i>Computer Simulation of Steel Microstructure Composition for Induction Hardening of a Splined Shaft for Various Cooling Rates</i>	111
Suraj Murali, Christian Bothen, Srivijay Manjunath, Ebrahim Bagheri, Mohamed Loukil, Daniel Pelikan, Kristiaan Pelckmans and Dragos Dancila	
<i>Energy Efficient Solid-State Microwave Curing of Carbon Fiber Reinforced Composites</i>	113
Ivan Smolianov, Vaclav Kotlan and Ivo Dolezel	
<i>Approaches to Modernize Induction Heater for Purpose of Heat Treatment of Titanium Alloys</i>	115
Jakub Jirinec, Michal Knedlik and David Rot	
<i>Possibilities of Using an Energy Surplus of Photovoltaic Power Plants</i>	117
Jakub Jiřinec, Lenka Raková and David Rot	
<i>Controlled Ventilation of Interior Spaces Using a Central Recuperation Unit</i>	119
David Rot, Michal Knedlik, Jakub Jirinec, Jiri Hajek, Jiri Kozeny and Antonin Podhrazky	
<i>Cost reduction opportunities in induction surface hardening processes for smaller diameter cylindrical loads</i>	121
Vaclav Kotlan, Roman Hamar, Karel Slobodnik and Ivo Dolezel	
<i>Modeling of temperature patterns and hardness of surfaces obtained by additive technique</i>	123
Jan Kohout and Lenka Sroubova	
<i>Modeling of the heat transfer in the switchboard cabinet</i>	125