

# **Open School-Conference of NIS Countries - Ultrafine Grained and Nanostructured Materials - 2020 (UFGNM-2020)**

IOP Conference Series: Materials Science and Engineering  
Volume 1008

Ufa, Russia  
5 - 9 October 2020

ISBN: 978-1-7138-4544-7  
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](mailto: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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

Preface	
Committees	
Peer review declaration	
Friction: from Leonardo da Vinci to modern nanotechnologies.....	1
<i>A V Makarov</i>	
Nano-mechanical testing of Al-Nb metal matrix composites consolidated by high pressure torsion after annealing .....	7
<i>R R Mulyukov, K S Nazarov, R U Shayakhmetov, G F Korznikova, E A Korznikova</i>	
Size-dependent phase stability of silver nanoparticles .....	12
<i>A M Murzakaev</i>	
Ultrasonic welding of metals: instruments, process parameters, and prospects of welding of ultrafine grained materials.....	17
<i>A A Mukhametgalina, M A Murzinova, A A Nazarov, N Yu Parkhimovich, A A Samigullina, E R Shayakhmetova, A P Zhilyaev</i>	
Structural and micromechanical properties of 316L stainless steel produced by selective laser melting.....	24
<i>A V Makarov, V P Kuznetsov, V A Sirosh, E G Volkova, P A Skorynina, A G Merkushev</i>	
Effect of electric pulse treatment on the structure and hardness of nickel deformed at room and liquid nitrogen temperatures.....	30
<i>R R Ilyasov, A Kh Valeeva, I Sh Valeev, O Sh Sitdikov, M V Markushev</i>	
Microstructure and properties of solid state joints of titanium sheets produced by ultrasonic welding .....	35
<i>A A Mukhametgalina, M A Murzinova, A A Nazarov</i>	
Microstructure and mechanical properties of a nickel-base superalloy heavily alloyed with substitution elements .....	40
<i>R I Zainullin, A A Ganeev, R V Shakhov, S K Mukhtarov, V M Imayev, R M Imayev</i>	
Ultrasonic welding of ultrafine grained nickel.....	45
<i>E R Shayakhmetova, A A Nazarov, A A Samigullina, A P Zhilyaev</i>	
Effect of post-forging heat treatment on the microstructure and mechanical properties of a nickel-base superalloy SDZhS-15 .....	50
<i>K S Mukhtarova, R V Shakhov, A A Ganeev, S K Mukhtarov, A V Logunov, V M Imayev</i>	
Influence of superplastic deformation on the quality of solid-phase joints obtained by welding of crystalline alloys.....	56
<i>R Ya Lutfullin, M Kh Mukhametrahimov, E V Galieva</i>	
Use of high hydrostatic pressure for food sterilization and seed treatment .....	60
<i>A Yu Volkov, N A Kruglikov, A V Alexandrov, V V Kotkova</i>	

Accumulative high-pressure torsion of steel 316 and $\beta$ -Ti alloy .....	64
<i>D V Gunderov, D A Khasanova, V V Astanin, A A Churakova, I A Ramazanov, S D Prokoshkin, V A Sheremetyev</i>	
Computer simulation of friction stir processing of plate from 2024 aluminum alloy.....	69
<i>A Kh Akhunova, M F Imayev, A Kh Valeeva</i>	
Finite-element modeling of the stress-strain state in disk-shaft type parts from dissimilar Ni-based alloys .....	74
<i>A Kh Akhunova, V A Valitov, E V Galieva</i>	
Protective PEO-coatings on titanium shape memory alloy for medical implants.....	79
<i>S R Shechtman, R G Farrakhov, I A Ramazanov, V A Sheremetyev, E V Parfenov</i>	
Models and parameters of Cosserat hexagonal lattices with chiral microstructure .....	84
<i>A A Vasiliev, I S Pavlov</i>	
Evolution of particles of secondary phases in alloys of the Cu-Cr-Zr system in the state of a supersaturated solid solution in the process of deformation-heat treatment .....	88
<i>R G Chembarisova, A V Galaktionova</i>	
Synthesis and Characterization of (Ag <sub>2</sub> S) <sub>x</sub> (ZnS) Heteronanostructures .....	95
<i>Stanislav I. Sadovnikov, Eugeny Yu. Gerasimov</i>	
Simulations of ZnS deposition on Ag <sub>2</sub> S surface and formation of Ag <sub>2</sub> S/ZnS heteronanostructure .....	100
<i>Ilya A Balyakin, Stanislav I Sadovnikov</i>	
Optimization of high pressure torsion processing for fabrication of the Al-Nb hybrid system.....	106
<i>G R Khalikova, G F Korznikova, K S Nazarov, R Kh Khisamov, S N Sergeev, R U Shayakhmetov, R R Mulyukov</i>	
Effect of nanostructuring on the thermal expansion and saturation magnetization of Fe - 36% Ni and Fe - 50% Ni alloys .....	111
<i>K A Krylova, I Kh Bitkulov, R R Mulyukov</i>	
Structure, thermal stability and mechanical properties of composite wires made of conducting microalloyed aluminum alloys .....	116
<i>A V Nokhrin, I S Shadrina, V N Chuvil'deev, A A Bobrov, V I Kopylov, N N Berendeev, A V Piskunov</i>	
Corrosion resistance of ultrafine-grained pseudo- $\alpha$ titanium alloy PT-3V .....	122
<i>A V Nokhrin, V I Kopylov, P V Andreev, V N Chuvil'deev, C V Likhmitskii, M K Chegurov, A A Murashov, D A Gudz'</i>	
Effect of friction stir processing on the strengthening of the 2024 aluminum alloy.....	128
<i>A Kh Valeeva, A Kh Akhunova, M F Imayev, R F Fazlyakhmetov</i>	
Structure and properties of Cu-based alloys diluted by Pd and Ag .....	133
<i>E G Volkova, O S Novikova, A E Kostina, A V Glukhov, A Yu Volkov</i>	
Effect of accumulative high-pressure torsion on the structure of steel 10.....	138
<i>I A Ramazanov, D V Gunderov, V V Astanin, V D Sitdikov, G T Zakiryanova, A V Sharafutdinov</i>	
Theoretical estimation, simulation and experimental evaluation of deformation-induced heating of magnesium during lateral extrusion .....	142
<i>D A Komkova, J V Zamaraeva, Yu N Loginov, P S Koshevoy, A L Sokolov, A Yu Volkov</i>	

High-pressure torsion of Zr-based bulk metallic glasses and amorphous melt-spun ribbons.....	147
<i>D A Khasanova, D V Gunderov, V V Astanin, S D Gunderova, A A Churakova, A I Bazlov, D V Louzguine-Luzgin</i>	
Surface polymorphism of silica nanoparticles.....	151
<i>V V Syzrantsev, E A Paukstis, T V Larina</i>	
High density of shear bands in the Vitreloy bulk metallic glass subjected to high-pressure torsion.....	157
<i>Vasily Astanin, Dmitry Gunderov, Zhi Qiang Ren, Ruslan Valiev, Jing Tao Wang</i>	
Work function of chemical compounds of aluminum-magnesium system.....	161
<i>R Kh Khisamov, A A Kistanov, K S Nazarov, R U Shayakhmetov, G F Korznikova, Yu M Yumaguzin, S V Dmitriev, R R Mulyukov</i>	
Modified hybrid CdSe/ZnS quantum dots and their size dependent unique characteristics .....	166
<i>A F Ishankulov, R R Shamilov, Yu G Galyametdinov, N K Mukhamadiev</i>	
Regimes of mass transfer in a 2D crystal in nonequilibrium states .....	171
<i>E A Korznikova, I A Shepelev, E L Vardanyan, K N Ramazanov, P V Zakharov</i>	
Synthesis of the catalysts based on oxides of some d-elements .....	175
<i>Kh M Saidov, N K Mukhamadiev</i>	
Mass transfer in platinum by crowdion clusters initiated by the impact of a Pt <sub>2</sub> molecule.....	180
<i>I A Shepelev, S V Dmitriev, A Yu Morkina, S Yu Fomin, E A Korznikova</i>	
X-ray analysis of the Cu-Zn alloys system subjected to ECAP and subsequent rolling.....	185
<i>L I Zaynullina, I V Alexandrov</i>	
Calculation of hardening contributions of the TiNi alloy undergoing martensitic transformations in a free state.....	190
<i>A A Churakova, D V Gunderov, N E Tolstov, D K Magomedova</i>	
Mechanical properties and structure of welded joints of VT6 alloy through nanocrystalline interlayer of VT22 .....	195
<i>M Mukhametrakhimov</i>	
Silver nanoparticles formation over Ti-Zr-Nb alloy via polyol synthesis .....	200
<i>T O Teplyakova, D V Popova, S D Prokoshkin, A S Konopatsky</i>	
Features of structure and physical and mechanical properties of metal-ceramic composite material depending on the content of boron nitride.....	206
<i>B O Bolshakov, A M Smyslov</i>	
Study of the deformation behavior and structure formation of Ti-Zr-Nb shape memory alloy.....	212
<i>V A Sheremetyev, O Akhmadkulov, V S Komarov, A V Korotitsky, S P Galkin, V A Andreev, S D Prokoshkin</i>	
Nanowhiskers for lithium battery anode.....	218
<i>E Podlesnov, M V Dorogov</i>	
Copper oxide nanowhiskers: structure, growth mechanisms, and associated stresses.....	223
<i>E Podlesnov, N V Churkunova, M V Dorogov</i>	
Influence of free torsion deformation modes on the microstructure and mechanical properties of commercially pure copper .....	227
<i>I S Kodirov, G N Aleshin, A G Raab</i>	

Superplastic behaviour and solid state weldability of a polycrystalline heavily alloyed nickel-base superalloy .....	232
<i>Sh Kh Mukhtarov, V M Imayev, A A Ganeev, R V Shakhov, A V Logunov</i>	
Research and features of preliminary graphitizing processing of melt of iron with silicon carbide on the structure and properties of cast iron castings .....	237
<i>D.A. Boldyrev, S.I. Platov, N.V. Urtsev, D.V. Terentyev, O.R. Latypov</i>	
Structure of copper-containing nanocomposites obtained by electrochemical synthesis .....	242
<i>I Yu Isaeva, G Yu Ostaeva, I V Odinkova, E A Eliseeva, V I Busko</i>	
Experimental study of the influence of different carbon content on the shrinkage kinetics and structure evolution of ultralow-cobalt hard alloys during spark plasma sintering .....	246
<i>E A Lantsev, A V Nokhrin, M S Boldin, N V Malekhonova, P V Andreev, K E Smetanina, A A Popov</i>	
Superplastic forming of hemispheres out of AZ61 magnesium alloy .....	252
<i>A A Kruglov, O P Tulupova, N V Olimpieva, V R Ganieva, F U Enikeev</i>	
Effect of the structural elements size of crumpled graphene on hydrogen sorption: atomistic simulation .....	255
<i>N G Apkadirova, K A Krylova</i>	
Molecular dynamics simulation of diffusion in Mg-Al system under pressure .....	260
<i>P V Polyakova, J A Baimova</i>	
Model calculation of the phase diagram of Cu-Te .....	266
<i>A R Kurbangulov, L V Tsygankova, E V Tikhonov, N N Bikkulova, D I Safargaliyev, G R Nigmatullina, G R Akmanova</i>	
Molecular dynamics simulation of crumpled graphene filled with Ni nanoparticles .....	272
<i>L R Safina, R T Murzaev, K A Krylova</i>	
Structural and phase transformations in austenitic chromium-nickel steels during nanostructuring frictional treatment .....	278
<i>P A Skorynina, A V Makarov, E G Volkova, A L Osintseva</i>	
Rheological behavior of a Cu-Cr alloy subjected to severe plastic deformation .....	284
<i>R N Asfandiyarov, D A Aksenov, G I Raab, M P Baryshnikov</i>	
Contribution of structural parameters to the strength and electrical conductivity of Cu-0.5%Cr alloy subjected to ECAP and cold rolling .....	289
<i>E A Sarkeeva, I V Alexandrov</i>	
Crystallography and energy of planar superstructure defects of ternary alloys .....	296
<i>A R Khalikov, V T Nguen, V A Valitov, S V Dmitriev</i>	
Influence of rolling modes and the level of accumulated deformation on the mechanical and plastic properties of stainless austenitic steel AISI 304L .....	300
<i>A G Raab, G I Raab, S V Dobatkin, A A Tokar, P La</i>	
Features of the formation of a diffusion layer and the mechanism of diffusion during boronizing of steels .....	306
<i>A.M. Guryev, S. G. Ivanov, M. A. Guryev, S. Mei, B.D. Lygdenov</i>	

Influence of composition nonstoichiometry and ordering effects on the properties of ferroelectric ceramics based on lead magnoniobate.....	311
<i>A R Lebedinskaya, A G Rudskaya</i>	
Superplastic behavior of a nickel-base superalloy containing topologically close-packed phases.....	316
<i>S K Mukhtarov, A A Ganeev, R V Shakhov, V M Imayev, A V Logunov</i>	
Behaviour of carbon nanotube bundle under quasistatic and dynamic transverse compression.....	321
<i>L Kh Rysaeva, R T Murzaev, A A Kudreyko, E A Korznikova, S V Dmitriev</i>	
Influence of structural state on corrosion behaviour of bearing steel 110C-18Cr-Mo .....	326
<i>M M Abramova, E R Tuktamysheva, Yu B Saburova, N A Enikeev</i>	
Microstructure and phase composition of Al-Nb metal-matrix composites produced by shear deformation under pressure .....	330
<i>V N Danilenko, L U Kiekkuzhina, K S Nazarov, R R Mulyukov</i>	
Peierls-Nabarro potential for kinks in nonlinear chains .....	335
<i>Yu V Bebikhov, S V Dmitriev</i>	
Dynamics of supersonic N-crowdions in bcc tungsten.....	341
<i>R T Murzaev, E A Korznikova, S V Dmitriev</i>	
Interaction of supersonic 2-crowdions in fcc platinum .....	345
<i>A M Bayazitov, E A Korznikova, A S Semenov, D I Borisov, S V Dmitriev</i>	
Behavior of the mechanical system composed of highly deformable structural elements .....	349
<i>D U Abdullina, L Kh Rysaeva, E A Korznikova, S V Dmitriev</i>	
Comparative analysis of fine-grained structure formation in an Al-Zn-Mg-Cu alloy during multidirectional isothermal forging and uniaxial compression .....	354
<i>O Sitdikov, T Sakai</i>	
Methods of controlling mechanical behavior of layered titanium material under impact loading .....	360
<i>A A Sarkeeva, A A Kruglov, R Ya Lutfullin</i>	
Concentration wave method for description of all possible energy states of A2BC ordered alloy.....	365
<i>A R Khalikov, V T Nguen, V A Valitov, S V Dmitriev</i>	
Properties of one-dimensional nonlinear vibrational modes in triangular lattice with Lennard-Jones interactions .....	370
<i>I R Sunagatova, A M Subkhangulova, M N Semenova, D I Borisov, A S Semenov, S V Dmitriev</i>	

## **Author Index**