

Nanomaterials by Severe Plastic Deformation: NanoSPD5

PART 1



Selected, peer reviewed papers from the
5th International Conference on
Nanomaterials by Severe Plastic Deformation
held in Nanjing, China
on March 21 - 25, 2011

Edited by

**Jing Tao Wang
Roberto B. Figueiredo
Terence G. Langdon**

ttp **TRANS TECH PUBLICATIONS LTD**
Switzerland • UK • USA

Copyright © 2011 Trans Tech Publications Ltd

All rights reserved. No part of the contents of this publication may be reproduced or transmitted in any form or by any means without the written permission of the publisher.

Trans Tech Publications Ltd
Laubisrutistr. 24
CH-8712 Stafa-Zuerich
Switzerland
<http://www.ttp.net>

Volumes 667-669 of
Materials Science Forum 2-vol. set
ISSN 0255-5476

Full text available online at <http://www.scientific.net>

Distributed worldwide by

Trans Tech Publications
Laubisrutistr. 24
CH-8712 Stafa-Zuerich
Switzerland

Fax: +41 (44) 922 10 33
e-mail: sales@ttp.net

and in the Americas by

Trans Tech Publications Inc.
PO Box 699, May Street
Enfield, NH 03748
USA

Phone: +1 (603) 632-7377
Fax: +1 (603) 632-5611
e-mail: sales-usa@ttp.net

printed in Germany

Table of Contents

Sponsors and Organizers	v
Committees	vi
Preface	vii
The NanoSPD Award	viii

Part 1

I. Introduction

Major Landmarks of NanoSPD Activity: International Conferences from NanoSPD1 to NanoSPD5	
R.Z. Valiev	3
Processing by Severe Plastic Deformation: Historical Developments and Current Impact	
T.G. Langdon	9

II. Principles of SPD Processing

Nanostructure Formation and Amorphization in Intermetallic Compounds by Severe Plastic Deformation	
K. Tsuchiya and O. Ciuca	17
Severe Plastic Deformation Processes with Friction Induced Shear	
R. Lapovok, Y. Estrin, R. Djugum and A. Lerk.....	25
Twist Extrusion: Fundamentals and Applications	
V. Varyukhin, Y. Beygelzimer, R. Kulagin, O. Prokofeva and A. Reshetov.....	31
Equal-Channel Angular Pressing of NiAl	
W. Skrotzki, R. Chulist, B. Beausir and M. Hockauf	39
Strain Compatibility and Nanostructuring of Bulk Metallic Materials via Severe Plastic Deformation	
F.Z. Utyashev	45
High-Pressure Torsion for Ring Samples in Different Thicknesses	
H. Iwaoka, Y. Harai and Z. Horita.....	51
Comparison of Different Extrusion Methods for Compaction of Powders	
A. Molotnikov, R. Lapovok, T. Peng and Y. Estrin.....	57
Nanostructured Dual Phase Ti-Al through Consolidation of Particles by Severe Plastic Deformation	
E.W. Lui, W. Xu and K.N. Xia	63
Effect of a Special ECAP Die Configuration on Microhardness Distributions in Pure Aluminum	
Z.C. Duan and T.G. Langdon.....	69
Finite Element Simulation of Die Design for Warm Equal Channel Angular Extrusion Process of AZ31 Alloy and its Experimental Investigation	
S.B. Xu, C.N. Jing, G.C. Ren and P. Liu	75
Finite Element Simulation of Effects of Mould Angle and Friction on ECAP for AZ80 Magnesium Alloy	
G.Y. Cai, X.T. Huang and S.X. Zhang	81
Nano-Refinement, Nano-Consolidation: Different Fabrication Routes of Nano-Crystalline Aluminium Alloys	
M. Lewandowska, H. Dybiec, M. Kulczyk, J. Latuch and K.J. Kurzydowski	87

Application of High-Pressure Sliding for Grain Refinement of Al and Mg Alloys K. Tazoe, S. Honda and Z. Horita.....	91
Simple Shear: Double-Stage Deformation Y. Beygelzimer, R.Z. Valiev and V. Varyukhin.....	97
Severe Plastic Deformation by Equal Channel Angular Swaging E. Bruder, M.O. Görtan, P. Groche and C. Müller.....	103
Study on the Fabrication of Nanocrystalline Copper by Explosive Dynamic Loading J.X. Wang, N. Zhou and R. Yang.....	109
Simulation of Multi-Pass ECAP by 3D Finite Element Method L. Bao, H. Ding, W.J. Zhao and R.B. Mei.....	115
Current Practice and Future Opportunities for Two-Turn ECAP A. Rosochowski and L. Olejnik.....	121
The Novel Continuous Large Deformation Technology Integrating Conventional Rolling with Equal-Channel Angular Technology X.D. Zhu, X.J. Xu, Z.H. Zhao, K. Chong, C. Cheng and X.N. Cheng.....	127
Influence of ECAR Processing on OFHC Cu Material Properties T. Kvačakaj, M. Kvačakaj, V. Stoyka, R. Kočiško, J. Bidulská and J. Bacso.....	133
Experimental Studies and Modelling Analysis of Commercial Purity Iron Processed by Asymmetric Rolling X.M. Li and Y. Ding.....	139
Ag Powders Consolidated by Reciprocating Extrusion (CEC) M. Richert, J. Richert, A. Hotłoś, P. Pałka, W. Pachla and M. Perek.....	145
Nanocrystallization and Dissolution of Immiscible Powder Alloys Using High Pressure Torsion S. Kahofer, M.J. Zehetbauer, H. Danninger, E. Schafner, M. Kerber and J. Horky.....	151
Effect of Severe Cold-Rolling and Subsequent Annealing on Microstructure and Properties of <i>in-Situ</i> Composite Steel J. Zhao, H. Zhang, Y.M. Yang, J.C. Chen, Q.X. Wen, Z. Wang, L.T. Zhang and Y.W. Gao.....	157
Effect of Combined Rolling Processes on Structure and Mechanical Properties of Pure Titanium Rods N. Lopatin, G. Diakonov and O. Pleshakova.....	161
 III. Microstructural Evolution and Grain Refinement	
Atomic Scale Investigation of Impurity 3D Distribution in Nanocrystalline Ni Processed by SPD X. Sauvage, G. Wilde and R.Z. Valiev.....	169
Microstructure Evolution and Tensile Properties of 304L Stainless Steel Subjected to Surface Mechanical Attrition Treatment P. Jiang, J. Lu and X.L. Wu.....	175
Grain Size Effect on Deformation Twinning and De-Twinning in a Nanocrystalline Ni-Fe Alloy S. Ni, Y.B. Wang, X.Z. Liao, S.N. Alhajeri, H.Q. Li, S.P. Ringer, T.G. Langdon and Y.T. Zhu.....	181
X-Ray Analysis of α and ω – Phases of Ti, Subjected to High-Pressure Torsion V.D. Sitdikov, I.V. Alexandrov and J.T. Bonarski.....	187
Microstructure and Properties of T2 Copper Tube Produced by Severe Hot Rolling Y.L. Wang, Y. Liu, J.T. Wang and F.S. Tian.....	193

Obtaining a Homogeneous Fe-C Nanostructure from a Ferritic-Pearlitic Dual-Phase Steel by High Pressure Torsion	
J.L. Ning, Y. Ivanisenko, D. Wang, M.Y. Murashkin and H.J. Fecht	199
Disorientations after Severe Plastic Deformation and their Effect on Work-Hardening	
W. Pantleon	205
Annealing Behavior of Solution Treated and Aged Al-0.2wt% Sc Deformed by ARB	
E. Borhani, H. Jafarian, H. Adachi, D. Terada and N. Tsuji	211
Microstructure and Mechanical Properties of Accumulative Roll Bonded AA6014/AA5754 Aluminium Laminates	
T. Hausöl, H.W. Höppel and M. Göken	217
Microstructural Evolution in an Al-6061 Alloy Processed by High-Pressure Torsion and Rapid Annealing	
A. Loucif, R.B. Figueiredo, T. Baudin, F. Brisset and T.G. Langdon	223
Microstructure and Properties of a Fe-Cu Composite Processed by HPT Powder Consolidation	
A. Bachmaier and R. Pippan	229
Quantitative Characterization of Microstructure in Copper Processed by Equal-Channel Angular Pressing	
P. Král, J. Dvořák, M. Kvapilová, M. Svoboda, V. Beneš, P. Ponížil, O. Šedivý and V. Sklenička	235
Influence of the Precipitation State on Thermal Stability of an Ultra-Fine Grained AlMnFe-Alloy Produced by Equal Channel Angular Pressing	
R. Berghammer, W.P. Hu, A. Hasani and G. Gottstein	241
Structural Evolution on the Cross-Section of an AZ31 Magnesium Alloy Processed by High-Pressure Torsion	
R.B. Figueiredo and T.G. Langdon	247
Investigations on Microstructure Evolution and Deformation Behavior of Aged and Ultrafine Grained Al-Zn-Mg Alloy Subjected to Severe Plastic Deformation	
W.P. Hu, S.Y. Zhang, X.Y. He, Z.Y. Liu, R. Berghammer and G. Gottstein	253
Aging Behavior of Al-Mg-Si Alloys Processed by High-Pressure Torsion	
D. Akama, Z. Horita, K. Matsuda and S. Hirose	259
Grain Boundary Segregation of Carbon and Formation of Nanocrystalline Iron-Carbon Alloys by Ball Milling	
Y.Z. Chen, A. Herz and R. Kirchheim	265
Texture Evolution in Pure Copper Processed by Equal Channel Angular Extrusion with Extended Processing Routes	
S.Y. Li and H. Li	271
The Evolution of Homogeneity during Processing of Aluminium Alloys by HPT	
S.N. Alhajeri, M. Kawasaki, N. Gao and T.G. Langdon	277
On the Theoretical Limits of Microstructure Evolution in Severe Plastic Deformation	
S.V. Divinski, K.A. Padmanabhan and G. Wilde	283
Effect of Multiaxial Forging on Structure Evolution and Mechanical Properties of Oxygen Free Copper	
G.A. Salishchev, N.D. Stepanov, A.V. Kuznetsov, S.V. Zherebtsov, O.R. Valiakhmetov, A.A. Kuznetsov and S.V. Dobatkin	289
Effect of Cold Rolling on Structure and Mechanical Properties of Copper Subjected to Different Numbers of Passes of ECAP	
N.D. Stepanov, A.V. Kuznetsov, G.A. Salishchev, G.I. Raab and R.Z. Valiev	295

Structure and Properties of Ultrafine-Grained Cu-Cr Alloys after High Pressure Torsion	
D.V. Shangina, N.R. Bochvar and S.V. Dobatkin	301
Aging Behavior of Cu-Ni-Si Alloy Processed by High-Pressure Torsion	
H. Matsunaga, Z. Horita, K. Imamura, T. Kiss and X. Sauvage.....	307
Annealing Behavior of FeNi Alloy Processed by High-Pressure Torsion	
S. Lee and Z. Horita	313
Microstructure Evolution of Pure Nickel up to a High Strain Level during Equal-Channel Angular Pressing	
F. Liu, Y. Zhang and J.T. Wang.....	319
The Evolution of Structure and Mechanical Properties of Fe-Mn-V-Ti-0,1C Low-Carbon Steel Subjected to Severe Plastic Deformation and Subsequent Annealing	
G.G. Zakharova, E.G. Astafurova, E.V. Naydenkin, G.I. Raab and S.V. Dobatkin.....	325
Enhanced Thermal Stability and Mechanical Properties of Ultrafine-Grained Aluminum Alloy	
R.K. Islamgaliev, M.A. Nikitina and A.F. Kamalov.....	331
Microstructures and Mechanical Properties of Pure Titanium by Dynamic Plastic Deformation	
J.L. Sun and J.T. Wang	337
A Study on Characteristics of Microstructures and Orientations of UFG Materials Prepared by SPD	
Q.N. Shi, Y.J. Chen and J.L. Wang.....	343
Recrystallization Mechanisms Leading to the Formation of Nanoscale Grains in a Ni-20%Cr Alloy Subjected to Intense Plastic Deformation	
N. Dudova, A. Belyakov and R. Kaibyshev.....	349
Microstructure and Texture of Magnesium Single Crystals Processed by ECAP	
P. Šedá, A. Jäger and P. Lejček.....	355
Martensitic Transformation from Ultrafine Grained Austenite Fabricated by ARB in Fe-24Ni-0.3C	
H. Jafarian, E. Borhani, A. Shibata, D. Terada and N. Tsuji	361
Numerical Simulation and Experimental Investigation of Grain Refinement Behavior in Equal Channel Angular Pressing/Extrusion Process	
S. Xu, G.C. Ren, G.Q. Wang and P. Liu.....	367
Grain Subdivision of a Nb Polycrystal Deformed by Successive Compression Tests	
L. Zhu, H.R.Z. Sandim, M. Seefeldt and B. Verlinden.....	373
Influence of Stacking Fault Energy on the Microstructures and Grain Refinement in the Cu-Al Alloys during Equal-Channel Angular Pressing	
X.H. An, S.D. Wu and Z.F. Zhang.....	379
The Influence of Texture and Grain Size on Compressive Deformation Behavior of Pure Mg through Equal-Channel Angular Processing	
J.Z. Li, H. Ding, X.L. Wu, W. Xu and K.N. Xia	385
Microstructural Evolution of Mg-4Nd Alloy Processed by High-Pressure Torsion	
J. Bai, F. Xue, S.N. Alhajeri and T.G. Langdon	391
Developing the Technique of Severe Plastic Deformation Processing through High-Pressure Torsion	
M. Kawasaki and T.G. Langdon	397
High-Temperature Severe Plastic Deformation of Ferritic Steel by Torsion	
A. Setiawan, D. Terada and N. Tsuji	403

The Structure of Nb Obtained by Severe Plastic Deformation and its Thermal Stability	
V.V. Popov, E.N. Popova, A.V. Stolbovsky and V.P. Pilyugin	409
Microstructural Evolution of Ultrafine-Grained Steel during Tandem Rolling Process	
X.D. Huo, X.P. Mao and Y.Z. Chai	415
Microstructures and Tensile Properties of Maraging Steel Processed by Equal-Channel Angular Pressing	
M.X. Yang, G. Yang, Z.D. Liu, C.Y. Wang and C.X. Huang	421
Stabilization of Lattice Defects in HPT-Deformed Palladium Hydride	
M. Bönisch, M.J. Zehetbauer, M. Krystian, D. Setman and G. Krexner	427
Microstructure and Properties of Nanostructured Zirconium Processed by High Pressure Torsion	
A.V. Podolskiy, B.J. Bonarski, D. Setman, C. Mangler, E. Schafler, E.D. Tabachnikova and M.J. Zehetbauer	433
Mechanisms of Microstructure Refinement in Titanium during “abc” Deformation at 400°C	
S.V. Zherebtsov, E. Kudryavtsev and G.A. Salishchev	439
Texture Manipulation in Commercial Purity Aluminum by Deformation Path Change from ECAP to Plane Strain Compression	
E.A. El Danaf, M.S. Soliman and A.A. Almajid	445
TEM and DSC Investigation of the Recovery of a Recycled Aluminum Processed by Equal Channel Angular Extrusion	
A. Rebhi, T. Makhlof, J.P. Couzinié, Y. Champion and N. Njah	451
Microstructure and Mechanical Performance of AZ31-1.7 Wt.% Si Alloy Processed by Cyclic Channel Die Compression	
W. Guo, Q.D. Wang, M.P. Liu, T. Peng, X.T. Liu and H. Zhou	457
Enhancing the Efficiency of ECAP Processing in Particle Redistribution by Combination of Different Processing Routes	
W.L. Zhang, W. Liang, L.P. Bian and J.H. Jia	463
Decomposition of Nanostructured Martensite in Cu-Al Alloys Processed by High-Pressure Torsion	
G.F. Zhang, X. Sauvage, J.T. Wang, N. Gao and T.G. Langdon	469
Microstructure and Toughness of an AZ80 Mg Alloy Processed by ECAP and Ageing Treatment	
D.L. Yin, X. Chen and J.T. Wang	475
The Mechanical Performance of ARB Fabricated Hybrid Lamellar Composite of Recovered/Recrystallized Al and Precipitation Hardened Al(Sc) Layers	
M.Z. Quadir, O. Al-Buhamad and M. Ferry	481
Development of Ultra-Fine Grained Structure in an Al-5.4%Mg-0.5%Mn Alloy Processed by ECAP	
A. Kipelova, I. Nikulin, S. Malopheyev and R. Kaibyshev	487
Microstructure Evolution in a Cu-Ag Alloy during Large Strain Deformation and Annealing	
I. Shakhova, Y. Sakai, A. Belyakov and R. Kaibyshev	493
Grain Refinement and Hardening Induced by Heavy Deformation Using Low Energy High Current Pulsed Electron Beam Surface Treatment	
T. Grosdidier, Y. Samih, N. Allain-Bonasso, B. Bolle, Z.X. Zou, Y. Quin, S.Z. Hao and C. Dong	499

Synergetic Effect of ECAP and Friction Stir Welding on Microstructure and Mechanical Properties of Aluminium Sheets	
I. Nikulin, A. Kipelova, S. Malopheyev and R. Kaibyshev	505
Mechanism Responsible for Dynamic Recrystallization for Repeated Plastic Working Deformation Process	
X.D. Wang, W.B. Du, Z.H. Wang and S.B. Li	511
Dispersion of the Structure in Al-Based Alloys by Different Methods of Severe Plastic Deformation	
I.G. Brodova, I. Shirinkina and A. Petrova	517
Processing and Characterization of Pure Nickel Sheets by Constrained Groove Pressing (CGP) Technique	
S.S.S. Kumar and T. Raghu	523
Microstructure of Pure Ni Subjected to High Pressure Torsion	
H.W. Zhang, X.X. Huang, N. Hansen and R. Pippan	529
Effect of ECAP on the Dimensional and Morphological Characteristics of High Performance Aluminium PM Alloy	
J. Bidulská, T. Kvačkaj, R. Kočíško, R. Bidulský and M. Actis-Grande	535
Microstructure and Properties of Cu-5.7%Cr <i>In Situ</i> Fibrous Composite Produced by Equal-Channel Angular Pressing and Cold Rolling	
W. Wei, F. Wang, K.X. Wei, I.V. Alexandrov and J. Hu	541
Microstructure and Mechanical Properties of Ultra-Fine Grain AZ80 Alloy Processed by Back Pressure Equal Channel Angular Pressing	
N.X. Zhang, H. Ding, J.Z. Li, X.L. Wu, Y.L. Li and K.N. Xia	547
Nanostructure Evolution in an Austenitic Stainless Steel Subjected to Multiple Forging at Ambient Temperature	
A. Belyakov, K. Tsuzaki and R. Kaibyshev.....	553
Mechanical Properties and Microstructures of Severely Plastic Deformed Pure Titanium by Mechanical Milling and Spark Plasma Sintering	
M. Kubota and T. Ohno	559
The Formation of Submicrometer Scale Grains in a Super304H Steel during Multiple Compressions at 700°C	
M. Tikhonova, V. Dudko, A. Belyakov and R. Kaibyshev.....	565
Processing of Ultrafine Grained Cu-30%Zn Alloy through Severe Plastic Deformation Using Accumulative Roll Bonding	
S.G. Hashemi and B. Eghbali.....	571
The Evolution of Texture in AA 1050 Alloy Deformed by Equal-Channel Angular Pressing	
A.M. Kliauga, M. Ferrante and R.E. Bolmaro	577
Production of Bulk Ultrafine Grained Steel through Severe Plastic Deformation	
M.S. Ghazani and B. Eghbali.....	583
Anomalous Property Evolution during Annealing in HPTed SUS 304 Austenitic Stainless Steel	
I. Shuro, M. Umamoto, Y. Todaka, H.H. Kuo and H.C. Wang	589
Grain Refinement and Dispersion Precipitation of I-Phase in Mg-Zn-Y Alloy Processed by ECAP	
G.H. Min, H.W. Cui, Q.L. Lu, P. Gao and H.S. Yu.....	593
Effect of Severe Plastic Deformation on Microstructure and Properties of Al-Cu-Mg-Ag Aluminum Alloys	
D.H. Xiao, M. Song and K.H. Chen.....	599

Effect of Ultrasonic Treatment on the Microstructure and Properties of Nanostructured Nickel Processed by High Pressure Torsion	
A. Nazarova, R. Mulyukov, Y. Tsarenko, V. Rubanik and A. Nazarov	605
Effect of Asymmetrical Accumulative Roll-Bonding and Heat Treatment on the Formation of Ultra-Fine Twin Copper	
H. Mi, Q.N. Shi, J.L. Wang, L. Zhou and L.W. Chen	611
Mechanism of Grain Refinement Induced by Severe Plastic Deformation	
J. Kratochvíl	617
Grain Refinement in AZ61 Mg Alloy during Hot Cyclic Bending	
Y.P. Jiang, X.Y. Yang and L. Zhang	623
Evidence of Bulk Nanostructuring in Zr-Based Alloys under Deformation at Temperatures of $\alpha \leftrightarrow \beta$ Phase Transformations	
M. Isaenkova, Y. Perlovich, V. Fesenko, O. Krymskaya and A. Zavodchikov	629
Nano-Crystalline Structure in Mg₂Si/Mg-2.5Er-5Zn Composite on the Route of Repeated Plastic Working Process	
W.B. Du, X.D. Wang, Z.H. Wang and S.B. Li	635
Research on Temperature Change and Microstructure Evolution of Bore in Steel Target Penetrated by Copper Jets	
H. Chen and G. Tao	641

PART 2

IV. Mechanical Properties of SPD Materials

Cooperative Grain Boundary Sliding and Shear Banding at High Strains in Ultrafine Grained and Nanocrystalline Pd Alloys	
Y. Ivanisenko and H.J. Fecht	649
Effect of Hydrostatic Pressure on the Microstructure and Mechanical Properties during and after High Pressure Torsion	
E. Schafler	657
SPD-Induced Grain Boundary Segregations and Superior Strength in UFG Al Alloys	
N.A. Enikeev, M.Y. Murashkin, X. Sauvage, V.U. Kazykhanov and R.Z. Valiev	665
An Overview on the Fracture Behavior of Metals Processed by High Pressure Torsion	
A. Hohenwarter and R. Pippan	671
The Effect of Grain Boundary Sliding and Strain Rate Sensitivity on the Ductility of Ultrafine-Grained Materials	
N.Q. Chinh, T. Csanádi, J. Gubicza, R.Z. Valiev, B.B. Straumal and T.G. Langdon	677
Correlation of Physical Parameters with Steady-State Hardness of Pure Metals Processed by High-Pressure Torsion	
K. Edalati and Z. Horita	683
Mechanical Properties of Al-6061 and an Al-6061 Metal Matrix Composite Processed by High-Pressure Torsion	
C. Xu, Z. Horita and T.G. Langdon	689
Mechanical Characteristics of Zn-22% Al and Al-3% Mg Alloys Processed to High Strains by ECAP	
P. Kumar and T.G. Langdon	695
Strengthening and Toughening Effect on Tungsten Subjected to Multiple ECAP	
H. Yuan, Y. Zhang, A.V. Ganeev, J.T. Wang and I.V. Alexandrov	701

Strain Rate Sensitivity of Ultrafine-Grained CP-Ti Processed by ECAP at Room Temperature	
X.Y. Liu, X.C. Zhao and X.R. Yang.....	707
Mechanical Properties of Different Coppers Processed by Equal Channel Angular Pressing	
O.F. Higuera, J.A. Muñoz and J.M. Cabrera.....	713
Contribution of Twins to the Strengthening of Commercial Purity Titanium after Equal-Channel Angular Pressing	
Y. Zhang, S.N. Alhajeri, R.B. Figueiredo, N. Gao, J.T. Wang and T.G. Langdon.....	719
Influence of Nanoparticle Reinforcement on the Mechanical Properties of Ultrafine-Grained Aluminium Produced by ARB	
C.W. Schmidt, C. Knieke, V. Maier, H.W. Höppel, W. Peukert and M. Göken	725
Influence of Severe Plastic Deformation and Ageing on the Microstructure and Mechanical Properties of β-Alloy Ti-6.8Mo-4.5Fe-1.5Al	
I.P. Semenova and A. Medvedev	731
Strengthening of CP-Ti by Rolling at Room Temperature	
J.H. Jiang, Y. Ding and A.D. Shan	737
Application of High-Pressure Torsion to Al-Si Alloys with and without Scandium Additions	
K. Venkateswarlu, V. Rajinikanth, M.K. Sen, S.N. Alhajeri and T.G. Langdon.....	743
Mechanisms of Deformation Behavior of Coarse-Grained and Ultrafine-Grained Ti	
I.V. Alexandrov and R.G. Chembarisova	749
High Strength and Electrical Conductivity of UFG Copper Alloys	
Y. Champion, J.P. Couzinié, S. Tusseau Nenez, Y. Bréchet, R.K. Islamgaliev and R.Z. Valiev	755
Evolution of Adiabatic Shear Band in Ultra-Fine-Grained Iron under Dynamic Shear Loading	
F.P. Yuan and X.L. Wu.....	761
Microstructure and Mechanical Properties of Mg-3Y Binary Alloy Processed by Cyclic Extrusion and Compression	
X.T. Liu, M.P. Liu, Q.D. Wang, W. Guo and D.D. Yin	767
Using Atomic Force Microscopy to Examine Flow Processes in Materials Processed by ECAP	
Y. Huang and T.G. Langdon.....	773
CP-Ti Processed for Multiple Passes by ECAP at Room Temperature	
X.R. Yang, X.C. Zhao and X.Y. Liu.....	779
Influence of the SPD Processing Features on the Nanostructure and Properties of a Pure Niobium	
L.A. Kommel, V. Mikli, R. Traksmaa, M. Saarna, A. Pokatilov, S. Pikker and I. Kommel	785
Investigation on Three-Dimensional Microstructures and Tensile Properties of Pure Iron during Equal-Channel Angular Pressing	
G. Yang, M.X. Yang, Z.D. Liu, C. Wang and C.X. Huang	791
Effect of Impurities on the Microstructure of HPT Deformed Nickel	
G.B. Rathmayr and R. Pippan.....	797
Optimization of Tensile Strength and Ductility of Grade 2 Ti, Conditioned by Severe Plastic Deformation	
A.A. de A. Mendes Filho, V.L. Sordi and M. Ferrante.....	803

Influence of Strain Reversals during High Pressure Torsion Process on Strengthening in Al-Cu-Mg(-Li) Alloy	
J.W. Zhang, M.J. Starink, N. Gao and W.L. Zhou.....	809
Mechanical Properties of an Al-5.4%Mg-0.5%Mn-0.1%Zr Alloy Subjected to ECAP and Rolling	
S. Malopheyev, A. Kipelova, I. Nikulin and R. Kaibyshev	815
Microstructure Stability and Creep Behaviour of a Cu-0.2wt.%Zr Alloy Processed by Equal-Channel Angular Pressing	
J. Dvořák, P. Král, M. Kvapilová, M. Svoboda and V. Sklenička.....	821
Temperature Effects on the Mechanical Behavior of Ultrafine-Grained Material	
T. Suo, Y.L. Li, F. Zhao and K. Xie	827
Static and Cyclic Deformation of Commercially Pure Al Processed by Equal-Channel Angular Pressing Using Two Routes	
M.S. Soliman, E.A. El Danaf and A.A. Almajid	833
Enhancing Strength and Maintaining Ductility of Mg-3%Li-1%Sc Alloy by Equal Channel Angular Pressing	
H.J. Yang, X.H. Shao, S.X. Li, S.D. Wu and Z.F. Zhang.....	839
Comparison of High-Temperature Compressive Deformation Characteristics of Differently Processed LY12 Aluminum Alloys	
Y. Wang, Q.W. Jiang, Y. Wu and X.W. Li.....	845
Distribution of Mechanical Properties by Volume in Titanium Billets Processed by Twist Extrusion	
A. Reshetov, A. Korshunov, A. Smolyakov, Y. Beygelzimer, V. Varyukhin, I. Kaganova and A. Morozov	851
Mechanical Spectroscopy of Ultrafine Grained Copper	
I.S. Golovin and Y. Estrin.....	857
Ultrafine-Grained Steel Produced by Warm Rolling and Annealing of Lath Martensite	
X. Zhao and X.L. Yang.....	863
Flow Behaviour of Commercial Purity Titanium Subjected to Equal Channel Angular Pressing	
G.V.P. Kumar and U. Chakkingal.....	867
Near-Threshold Fatigue Crack Propagation in an ECAP-Processed Ultrafine-Grained Aluminium Alloy	
K. Hockauf, T. Halle, M. Hockauf, M.F.X. Wagner and T. Lampke	873
Effect of ECAP on the Microstructure and Mechanical Properties of 17-4PH Stainless Steel	
G. Yang and F.S. Yin.....	879
Precipitation Effect on Work Hardening Behavior of ECAP-Deformed Al-4%Cu Alloy	
E.F. Prados, V.L. Sordí and M. Ferrante.....	885
The Dynamic Behavior of Ultra-Fine-Grained Copper Fabricated by Equal Channel Angular Pressing	
Y.C. Dong, I.V. Alexandrov and J.T. Wang.....	891
Effect of Equal-Channel Angular Pressing on the Creep Resistance of Precipitation-Strengthened Alloys	
V. Sklenička, P. Král, J. Dvořák, M. Kvapilová, M. Kawasaki and T.G. Langdon.....	897
Ultrafine Structure Formation in Aluminium Alloy Processed by HPT and the Mechanical Properties Response	
J. Zrník, R. Pippan, S. Scheriau and M. Fujda.....	903

Production a High-Strength and High-Conductivity Copper Wire by Using Equal-Channel Angular Hydroextrusion Method	
O. Davydenkoa, V. Spuskanyuk and V. Varyukhin.....	909
Structure Evolution and Deformation Mechanisms in Ultrafine-Grained Aluminum under Tension at Room Temperature	
K.V. Ivanov and E.V. Naydenkin	915
Microstructure and Strength of Welded Joints of Steel after Equal-Channel Angular Pressing	
A.M. Ivanov, E.P. Soshnikova, A.A. Argunova, D.V. Gunderov and N.D. Petrova.....	921
Structure and Hardness of Cryorolled and Heat-Treated 2xxx Aluminum Alloy	
S.V. Krymskiy, E. Avtokratova, M.V. Markushev, M.Y. Murashkin and O.S. Sitdikov.....	925
Effect of ECAP on Mechanical Properties of an AA2014 Alloy	
R. Kaibyshev and A. Mogucheva.....	931
Optimization of Strength and Ductility in Ultra-Fine 304 Stainless Steel after Equal-Channel Angular Processing	
Z.J. Zheng, Y. Gao, Y. Gui and M. Zhu	937
Influence of Annealing on the Structure and Mechanical Properties of Ultrafine-Grained Alloy Ti-6Al-7Nb, Processed by Severe Plastic Deformation	
V. Polyakova, I.P. Semenova and R.Z. Valiev	943
Effect of ECAP on Microstructure and Mechanical Properties of an Al-Mg-Sc Alloy	
A. Mogucheva and R. Kaibyshev	949
Transient Yielding during Compression Tests on ECAP'ed AA1050 Aluminium	
B. Verlinden, E.Z. Chen, L. Duchêne and A.M. Habraken.....	955
Prediction of the Tension/Compression Asymmetry of ECAP Processed FCC Material Using an Integrated Model Based on Dislocation and Back-Stress	
E.Z. Chen, L. Duchêne, A.M. Habraken and B. Verlinden.....	961
Effect of ECAP on Mechanical Properties of an Al-Cu-Mg-Ag-Sc Alloy	
M. Gazizov, V. Telesov, V.V. Zakharov and R. Kaibyshev.....	967
Mechanical Properties and Microstructure of a Duplex Nanostructure	
L. Chen, P. Jiang, X.L. Wu, M.X. Yang, C. Wang and G. Yang.....	973
Hot Workability of Ultrafine-Grained Aluminum Alloy Produced by Severe Plastic Deformation of Al6063 Powder and Consolidation	
H. Asgharzadeh, A. Simchi and H.S. Kim.....	979
Influence of Thermal Cycling on Dilatation and Electrical Resistance of Ti - 49.8 at. %Ni Alloy after Hot Rolling	
R.I. Babicheva, I.Z. Sharipov and K.J. Mulyukov.....	985
On Gradient Nanomechanics: Plastic Flow in Nanopolycrystals	
X. Zhang, A.E. Romanov and E.C. Aifantis	991
Characterization of AM60 Magnesium Alloy Prepared by Rapid Solidification and Plastic Consolidation Technique	
T. Tokarski	997
Influence of Stacking Fault Energy on the Mechanical Properties and Work Hardening Behavior of Ultra-Fine (UF) Grained Cu and Cu Alloys	
P. Yang, H. Yang, J.M. Tao, C.J. Li, L. Shen and X.K. Zhu.....	1003
Effect of Post Annealing Treatment on Nano-Structured Low Carbon Steel Sheets Processed by Constrained Groove Pressing	
F. Khodabakhshi, M. Kazeminezhad, M. Azarnush and S.H. Miran.....	1009
Enhanced Plasticity of Cu-Based Laminated Composites Produced by Cold Roll-Bonding	
H.S. Liu, B. Zhang and G.P. Zhang	1015

Influence of Dissolved Precipitated Phases on Mechanical Properties of Severely Deformed Al-4 Wt% Cu Alloys	
N. Hu and X.C. Xu.....	1021
Fatigue Properties of Rapidly Solidified Mg-6Zn-1Y-0.6Ce-0.6Zr Alloy Processed by Reciprocating Extrusion	
Z.M. Zhang, C.J. Xu, T. Wang and L. Yang.....	1027
Microstructure and Mechanical Properties of an AZ31 Magnesium Alloy Processed by Accumulative Back Extrusion (ABE)	
M. Fatemi Varzaneh, J.M. Cabrera and A. Zarei Hanzaki.....	1033
Superplastic Flow of Metals Extruded by KoBo Method	
W. Bochniak, P. Ostachowski, A. Korbel and K. Piela	1039
V. Functional and other Properties of SPD Materials	
Hydrogen Activation Behavior of Commercial Magnesium Processed by Different Severe Plastic Deformation Routes	
D.R. Leiva, J. Huot, T.T. Ishikawa, C. Bolfarini, C.S. Kiminami, A.M. Jorge Jr. and W.J. Botta.....	1047
Hydrogen Sorption Properties of the Complex Hydride Mg₂FeH₆ Consolidated by HPT	
G.F. De Lima, D.R. Leiva, T.T. Ishikawa, C. Bolfarini, C.S. Kiminami, W.J. Botta and A.M. Jorge Jr.	1053
Phase Transformations and Functional Properties of NiTi Alloy with Ultrafine-Grained Structure	
E. Prokofiev, J. Burow, J. Frenzel, D.V. Gunderov, G. Eggeler and R.Z. Valiev	1059
Hysteresis Magnetic Properties of Nd-Ho-Fe-Co-B Alloys after Intense Plastic Deformation	
I.S. Tereshina, E.A. Tereshina, G.S. Burkhanov and S.V. Dobatkin.....	1065
Effect of Equal-Channel Angular Pressing on the Microstructure and Superelastic Behavior of Ti-25 at. % Nb Shape Memory Alloy	
J. Song, X.N. Zhang, X.G. Sun and C.Y. Xie	1071
Effect of the High Pressure Torsion on Magnetic Properties of Amorphous Alloys	
A.M. Glezer, M.R. Plotnikova, S.V. Dobatkin, N.S. Perov and A.V. Shalimova	1077
Electrochemical Properties of UFG CP-Ti in Ringer's Solution	
H. Jiang and C.Y. Xie	1083
Impact of Ball Milling and High-Pressure Torsion on the Microstructure and Thermoelectric Properties of p- and n-Type Sb-Based Skutterudites	
G. Rogl, M.J. Zehetbauer, M. Kerber, P. Rogl and E. Bauer.....	1089
Wear Resistance of SPD-Processed Alloys	
N. Gao, C.T. Wang, R.J.K. Wood and T.G. Langdon	1095
Wear Behaviour of Al-1050 Alloy Processed by Severe Plastic Deformation	
C.T. Wang, N. Gao, R.J.K. Wood and T.G. Langdon	1101
Sliding Wear Behavior of Severely Deformed 6061 Aluminum Alloy by Accumulative Roll Bonding (ARB) Process	
M. Eizadjou, A.K. Talachi, H.D. Manesh and K. Janghorban.....	1107
In Vitro Corrosion and Haemocompatibility of Bulk Nanocrystalline 304 Stainless Steel by Severe Rolling	
F.L. Nie, Y.B. Wang, S.C. Wei, Y.F. Zheng and S.G. Wang	1113
The Effect of Structure on Mechanical and Corrosion Properties of Austenitic Steel Subjected to Neutron Irradiation	
M.M. Abramova, I.V. Alexandrov, V.K. Shamardin, T.M. Bulanova and M.V. Karavaeva	1119

Investigation on Corrosion Behaviors of Ultra-Fine Grain Copper in 3.5% NaCl Solution	
Q.J. Wang, Y.C. Wang, Z.Z. Du and X.Y. Liu	1125
Overview on the Corrosion Behavior of Ultra-Fine Grained Materials Fabricated by Equal-Channel Angular Pressing	
D. Song, A.B. Ma, J.H. Jiang and P.H. Lin.....	1131
Phase Transformations and Super-Elasticity of a Ni-Rich TiNi Alloy with Ultrafine-Grained Structure	
Z.G. Fan, J. Song, X.N. Zhang and C.Y. Xie.....	1137
VI. Innovation and Applications	
Status of Commercialization of Nanostructured Metals	
T.C. Lowe	1145
Microstructural Features and Mechanical Properties after Industrial Scale ECAP of an Al 6060 Alloy	
P. Frint, M. Hockauf, T. Halle, G. Strehl, T. Lampke and M.F.X. Wagner.....	1153
Development of SPD Technologies and Establishment of a Production Line for Rod-Shaped Semiproducts out of Nanostructured Titanium for Medical Application	
G.I. Raab and F.Z. Utyashev	1159
Evolution of Microstructure and Mechanical Properties of Titanium Grade 4 with the Increase of the ECAP-Conform Passes	
A.V. Polyakov, D.V. Gunderov and G.I. Raab	1165
Interface Microstructure of Diffusion Bonded Fe₃Al/Al with Ultrafine Grain Layer	
J.W. Ren, D. Li and A.D. Shan	1171
Recycling of Aluminum Scrap by Severe Plastic Deformation	
J.R. Cui, W. Guo, H.J. Roven, Q.D. Wang, Y.J. Chen and T. Peng	1177
The Aspects of Practical Application of Ultrafine-Grained Titanium Alloys Produced by Severe Plastic Deformation	
E.V. Naydenkin, I.V. Ratochka and G.P. Grabovetskaya.....	1183
Development of Textured Coated Superconductor Substrate Tapes by Severe Plastic Deformation Processing	
P.P. Bhattacharjee and N. Tsuji	1189
Microstructure Evolution and the Influence of Hydrofluoric Acid Treatment on the Surfaces of Commercial Pure Ti after ECAE	
X.N. Zhang, C.L. Huang, J. Song, B. Chen, W.P. Ji, P. Han and C.Y. Xie.....	1195
Towards Perspective Applications of Nanostructured Ti in Medicine	
T. Reshetnikova, A.V. Shcherbakov, M.R. Salakhova and L. Khakimova	1201
Annealing Effect on the Performance of Sputtering Deposited Metglas Thin Films	
C. Liang, J. Hu, B.C. Prorok, C. Gooneratne and J. Kosel	1207
Keywords Index	1213
Authors Index	1219