



Materials Science, Mechanical Engineering and Applied Research

Edited by
Fangping Zhang

TTP TRANS TECH PUBLICATIONS



9 783038 352280

ISBN-13: 978-3-03835-228-0

Applied Mechanics and Materials Vol. 628

Electronically available at <http://www.scientific.net>

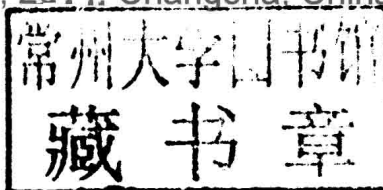
**Materials Science, Mechanical
Engineering and Applied Research**

Fangping Zhang



Materials Science, Mechanical Engineering and Applied Research

Selected, peer reviewed papers from the
2nd International Conference on Machinery,
Materials Science and Energy Engineering
(ICMMSEE 2014),
September 20-21, 2014, Changsha, China



Edited by

Fangping Zhang



Copyright © 2014 Trans Tech Publications Ltd, Switzerland

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
Churerstrasse 20
CH-8808 Pfaffikon
Switzerland
<http://www.ttp.net>

Volume 628 of
Applied Mechanics and Materials
ISSN print 1660-9336
ISSN cd 1660-9336
ISSN web 1662-7482

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



Distributed worldwide by

Trans Tech Publications Ltd
Churerstrasse 20
CH-8808 Pfaffikon
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

Applied Mechanics and Materials

ISSN: 1660-9336, ISSN/ISO: Applied Mechanics and Materials

Editors:

Publishing Editor: **Thomas Wohlbier**, 105 Springdale Lane, Millersville,
PA 17551, USA, t.wohlbier@ttp.net

Xi Peng Xu, Huaqiao University, Ministry of Education Engineering Research Center for
Brittle Materials Machining, Xiamen, 361021, China, xpxu@hqu.edu.cn

Aims and Scope:

Applied Mechanics and Materials is a book series specialized in the rapid publication of proceedings of international conferences, workshops and symposia as well as state-of-the-art volumes on topics of current interest in all areas of mechanics and topics related to materials science.

Internet:

The periodical is available in full text via www.scientific.net

Subscription Information:

Irregular: approx. 80-100 volumes per year. First volume in 2014: Vol. 440

The subscription rate for web access is EUR 1089.00 per year.

Standing order price for print copies: 20% discount off list price plus postage charges.

ISSN print 1660-9336 ISSN cd 1660-9336 ISSN web 1662-7482

Trans Tech Publications Ltd

Churerstrasse 20 • 8808 Pfaffikon • Switzerland

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

<http://www.ttp.net>

<http://www.scientific.net>

**Materials Science,
Mechanical Engineering
and Applied Research**

Edited by
Fangping Zhang

Preface

This volume is a collection of papers presented at the 2014 2nd international conference on Machinery, Materials Science and Energy Engineering will be held in Changsha, Hunan Province, China during September 20-21,2014.

The conference is organized by Hunan International Economics University, co-sponsored by University of Calgary, Canada, China University of Petroleum, Beijing, Hunan University, Central South University and Hunan Mechanical Engineering Society. The conference is sponsored by SJ Petroleum Machinery Co.

President of the conference is held by Prof. Fangping Zhang, Hunan International Economics University, China. Prof. Roger Qiu , The University of Massachusetts, America served as Chairman of the program Committee.

With the rapid development of Machinery, material science and energy engineering technology in China, new theory and application results constantly appear in the fields of machinery, material science and energy engineering. Higher and newer requirements on it are asked by more and more enterprise people and members of the engineering profession.

To further promote exchange and cooperation among states in the areas, to upgrade academic status and international influence on study of machinery, material science and energy engineering of China, to play a positive role on shortening international first-rate subject gap, this conference is held.

Eminent scholars at home and abroad will be invited to the conference and frontier as well as hot issues in the field of machinery, materials science and energy engineering will be exchanged and discussed deeply.

Online information concerning the conference is available under the following Uniform Resource Locator(URL):

<http://www.icmmsee.org>

Conference Chair of ICMMSEE2014

September 20-21,2014

Committees

Conference chairs:

Prof. Fangping Zhang, Hunan International Economics University, China

Program Committee Chairs

Prof. Roger Qiu , University of Massachusetts, America

Program Committee members

Prof. Paul Tu, University of Calgary, Canada

Prof. Xu Han, Hunan University, China

Prof. Jinke Gong, Hunan University, China

Prof. Zhou Li, Central South University, China

Prof. Naijun Zhou, Central South University, China

Prof. Yihu Wu, Changsha University of Science & Technology, China

Prof. Luping Li, Changsha University of Science & Technology, China

Prof. Zhengqi Gu, Hunan University of Science & Technology, China

Prof. Deguo Wang, China University of Petroleum in Beijing, China

Prof. Hongwu Zhu, China University of Petroleum in Beijing, China

Prof. Duanwei Shi, Wuhan University, China

Prof. Zunce Wang, Northeast Petroleum University, China

Prof. Xiaodong Zhang, Southwest Petroleum University, China

Prof. Guangxu Zhang, Wuhan University of Technology, China

Prof. Shuimin He, China University of Geosciences, China

Prof. Ding Feng, Yangtze University, China

Prof. Yishan Lou, Yangtze University, China

Prof. Shunshe Luo, Yangtze University, China

Prof. Zhijian Cui, Xi'an ShiYou University, China

Prof. Guangde Zhang, Wuhan University of Science and Technology, China

Prof. Zhao Li, Hunan International Economics University, China

Prof. Liuxian Pan, Hunan International Economics University, China

Prof. Jianmei Chen, Hunan International Economics University, China

Prof. Mengxiang Liu, Hunan International Economics University, China

Sponsors

Sponsored by Hunan International Economics University

Co-Sponsored by University of Calgary, Canada; China University of Petroleum, Beijing; Hunan University, Central South University and Hunan Mechanical Engineering Society

Table of Contents

Preface	v
Committees and Sponsors	vi

Chapter 1: Materials Science and Technologies

Inorganic Clay/Sodium Lignosulfonate Graft Acrylamide and Maleic Anhydride Adsorbent Composites Q.X. Yao, J.X. Liu, L.P. Tang and J.J. Xie.....	3
Microstructure and Mechanical Properties of Friction Stir Welded Al-Zn-Mg-Cu Alloy S.D. Liu, Y. Dai, Y.L. Wu, B. Chen and X.M. Zhang.....	7
Preparation of Adsorbent Composites Based on Bentonite/Sodium Lignosulfonate-g-AM Q.X. Yao, J.X. Liu, L.P. Tang and J.J. Xie.....	12
Study on Ni Catalytic Hydrogenation of Carbon Dioxide for Methane L. Zhou, L.P. Ma, Z.C. Zi, J. Ma and J.T. Chen	16
Acoustic Emission Study of Corrosion Fatigue Crack Propagation Mechanism Identification H. Chang	20
Synthesis and Characterization of Melamine-Formaldehyde Resin for Foaming Use J.X. Liu, L. Zhou, Q.B. Jiang, J. Yang and J.J. Xie.....	24
Synthesis and Characterization of 3-Difluoroaminomethyl-3-methyl Oxetane and its Homopolymer H. Li, R.M. Pan, W.J. Wang and L.Y. Zhang.....	28
The Existence Form and Distribution of Mn in Production of Tungsten Products Y.L. Li, D.Q. Tan, X. Yang, W. He, H.B. Zhu, L. Lu and D.P. Lu.....	33
Coat of Epoxy Resin Filled with Nano-Al₂O₃ and MoS₂ Erosion Wear Resistance and Application Y. Chen, K.H. Kou, B. Li and J.Y. Leng.....	40
Preparation and Characterization of the Sulfonated Polymer/Non-Woven Fiber Composite Catalytic Membrane for Esterification W.Y. Shi, H.B. Li and R. Zhou.....	44
Microstructure and Properties of Q345E Lamellar Tearing Resistant Steel SAW Welding Joints X.Q. Si, H.Y. Zhao, Y.X. Zhao, X.G. Song and X. Tian.....	48
High Temperature Cylinder Sleeve Design Research Self-Lubricating Materials H.X. Zhou, Z. Zhou and J.P. Liu	53
Catalysis Nanomaterial Research for NO High Temperature Cylinder H.X. Zhou, Z. Zhou and J.P. Liu	59
Bioceramic Scaffolds Manufacturing by Laser 3D Printing F.H. Liu, W.H. Lin, R.T. Lee, H.P. Wang and L.W. Lee	64

Thermodynamic Assessment of B_2O_3-SiO_2 Binary System	
H.M. Chen, J.M. Chen, S. Wang, W.T. Li, F.G. Meng, W.J. Chen, L. Li and S.J. Yao	68
Thermodynamic Assessment of SiO_2-ZrO_2 Binary System	
H.M. Chen, J.M. Chen, S. Wang, W.T. Li, F.G. Meng, W.J. Chen, L. Li and S.J. Yao	73
Through-Thickness Strain and Texture Gradients of Al-Mg-Si-Cu Alloy Sheets Produced by Snake Rolling	
L. Chen, J.G. Tang, S.D. Liu, X.M. Zhang, X. Li, B. Chen and Y.L. Deng	79
The Effects of Nano-SiO_2 on the Chemical Composition of Layers on Aluminum Alloy by Micro-Arc Oxidation	
X.B. Suo, J. Qiu, S.N. Ma and H.M. Wang	84
Memory and Threshold Resistance Switching in $Pb_{0.8}La_{0.1}Ca_{0.1}Ti_{0.975}/Zn_{0.99}La_{0.01}O$ Heterostructure	
B.W. Zeng, S.S. Wang, Z.P. Wang, M.H. Tang and D.L. Xu	89
Microstructure and Mechanical Properties of TiAlON/TiAlN/TiAl Films	
J. Zhang, J.J. Cai, W. Zhao and Z.G. Zhang	93
Factors Influencing Viscosity of Twin-Tail Hydrophobically Associating Polymer Weak Gel	
X.L. Qian, L. Wang, X.H. Yang and Y.X. Lin	98
Compatibilisation of Epoxy Resin on TPEE/PA6 Blends	
J. Li, S.M. Peng, Y.S. Huang and C.W. Yi	102
Polyaniline Hybrid with Inverse Opal Structure for Fabrication of Thermoelectric Materials	
Y.Q. He, Y. Feng, Q.J. Gong, C.Z. Yao, J.P. Gao and J. Yan	107
Effect of Pressure and Temperature of Solution Treatment on the Microstructure and Corrosion Resistance of AZ91D Alloy	
H.S. Lu and P.F. Yan	111
Producing High Quality $CaCO_3$ by Phosphogypsum with New Ammonia-Base Carbonation Method	
J. Ma, L.P. Ma, D.H. Zhang, B. Yan, L. Zhou and Z.C. Zi	115
Synthesis of Ionic Hydrophobic Associating Polymer and it's Aqueous Solution's Viscosity Characteristics	
F.Y. Feng and P.Z. Yu	120

Chapter 2: Applied Mechanics

The Nonlinear Random Vibration of a Clamped Rectangular Thin Plate in Magnetic Field	
J.X. Tu, Z.R. Wang, H. Zhu and P. Wang	127
Study of Metal Seal of Coiled Tubing Wellhead Hanging Device	
X.Y. Zhang and W.G. Ma	133
Research on the Fatigue Assessment Method for Steel Pressure Vessels Containing Surface Defects	
X.L. Meng	137

The Analysis Pressure Drop between Initial Station and 1#valve when Lan-Zheng-Chang Product Pipeline Shutdown	
Y.L. Xu	142
On Stress Conditions Producing Crack-Free Matrix Metal-Brittle Inclusion Interface inside Heavy Forgings	
Y.L. Ren, L.J. Niu, F.H. Cao and Q.W. Wang	146
Soft-Sensing Model of Deformation of Welded Steel Structure Based on FLS-SVM and its Application	
J.P. Lei and J.M. Chen	152
Three-Dimensional Ballistic Equations of Rocket Considering the Elastic Effects	
F. Liu	157

Chapter 3: Mechanical Engineering, Equipment and Control

Design and Experimental Simulation Analysis of a Kind of Prestressed Cementing Drillable Anchor	
Q. Zhang, D. Li, J. Wen, K.J. Luo and Z. Chen	163
Design Research of Intake Compensation Device for Improving the Dynamic Performance of Diesel Engine in Plateau Environment	
K.P. Zheng, Y.H. Chen and Z.B. Wei.....	167
Location of Partial Discharge Source Model Based on Transformer Single-Winding	
X.H. Song, X. Feng, Z.Z. Guo and J.F. Di	171
A Designing Method of Underwater Controller Based on Trajectory-Tracking Control Law for Underwater Profile Monitoring Vehicle	
W.X. Zhang, J. Yuan and Z.H. Zhou	177
A New Way to Eliminate the Phenomenon of Trapping Oil in Gear Pumps	
G.L. Yang, M.X. Li, J.Z. Wang and D.Y. Yin.....	181
The Correlation between Time and Frequency Dynamic Performance of Control System	
M.X. Zeng, J.F. Zhao and W. Ouyang.....	186
Design of Battery Fast-Swap System for Electric Vehicle	
W.N. Wang, B. Li and Y. Wang	190
Dynamic Simulation of Air Suspension with Auxiliary Chamber	
M.J. Zheng, X.L. Zhang and Z. Wang	195
Research on Impacting Loads between Metro Vehicles	
S.H. Zhang and H.M. Wang.....	199
How to Eliminate Machining Marks on the Surface of Impeller Blades by CimatronE CAM	
G.J. Fan	205
One Detection and Diagnosis System of a Certain Ordnance Equipment Based on μC/GUI Embedded Graphic User Interface	
H.B. Wang, B. Xu, Y. Zheng, W. Liu and K. Cheng	209
Study on Prediction Deflection of at the Girder Midspan of Large Tonnage Gantry Crane Rigid Legs	
D.P. Zhang, W.M. Cheng and K. Cai	214

Motor Faults Detection Based on Vector Transformation and Amplitude Demodulation	
G.J. Qin, J.Y. Li, J.M. Chen and N.Q. Hu	219
Energy Consumption and Energy Saving Research Status of Air Compressor System	
X.L. Tian, S.G. Hu, H.B. Qin, J. Zhao and L.Y. Ran	225
The Research of the Non-Circular Contour Grinding Speed Optimization and NC Programming	
D.F. Cao and J.N. Duan	229
Dynamic Analysis of Electrical Control Components under Tank Gun Firing Impact	
G.H. Wang and B. Zhao.....	235
Modeling and Simulation of the Ultrasonic Motor which Using Bending Vibration Transducer	
Z.L. Huang and W.S. Chen.....	240
Analysis of Catalytic Degradation Reaction Mechanism on Gasoline Engine Three-Way Catalysts	
J.J. Li	249
Design and Research on Automatic Control System Based on PLC	
Q. Zhai and Y. Li	253
Dynamic Sensitivity Research for the Spindle of High-Speed Grinder Based on the Artificial Neural Network	
G.P. Chen and G.L. Wen	257
Design and Test Research on Voice Coil Actuator Used for Active Isolation Platform	
J.F. Hou, W.H. Zhang, M. Jing, H.P. Wang and Y.C. Guo	261
The Analysis of Field Characteristics and Measurement for Centrifugal Fan and 90° Bend Pipe	
L.Y. Ran, J. Zhao, H.B. Qin, S.G. Hu and X.L. Tian	266
Numerical Simulation Analysis of Car Overtaking on SST Turbulence Model	
Y.B. He and Q.Z. Shen	270
Research on Numerical Simulation and Experiment of Plate Fin Type Intercooler in Turbocharged Natural Gas Engine	
M.X. Liu, X.L. Liu and D.Y. Wu	275
The CFD Analysis of Internal Flow Field in Turbocharger Compressor	
X.L. Liu, L.P. Hu, J.K. Gong and J.Q. E	279
The Study of Resonant Frequency of Horn and Circular Tool of Ultrasonic Milling System	
Y.D. Zhang and Z.Q. Ma	283
The Application of Oil Monitoring Technology in the Marine Hydraulic System	
B. Sun and X.C. Zhou	287
Experimental Study of Ejectors' Effect on the Performance of Pulse Detonation Rocket Engine	
Q.D. Bai and C.S. Weng	293
Study on the Thermal Performance of VSC-HVDC Cooling Plate Using Staggered Micro-Groove	
R. He, N.J. Zhou and B.B. Dai.....	299

Experimental Research on Phase-Change Cooling for High-Power Chip	
L.S. Wu, X. Zhang, C.J. Wang and Z.L. Wang	306
Theoretical and Computational Research of Heat Radiant Transfer in Cylinder	
H.X. Zhou, Z. Zhou and J.P. Liu	311

Chapter 4: Geoengineering and Applied Energy Research

Two High Activity Catalysts for the Reforming of Coke Oven Gas to H₂ and CO in BCFNO Membrane Reactor	
Z.B. Yang	319
Impact Energy of Gas-Solid Flows	
H.P. Zhu	323
Simulation and Analysis for a Heat Recycle System on the Sidewall of Aluminum Reduction Cells	
Y. Ming, Y. Guo and N.J. Zhou	327
Exergy Analysis of Energy Consumption for Central Air Conditioning System	
X.X. Xia, N.J. Zhou and Z.Q. Wang	332
A Novel SPES/PES Catalytic Membrane for Production Biodiesel: Optimization by Central Composite Design	
W.Y. Shi, H.B. Li and R. Zhou	338
Discussions on the Formation Mechanism of High-Angle Reverse Faults in Sanan Oil Field	
F. Yang, L.S. Si, J. Wang and G. Lin	342
Study on 3D Fine Structural Modeling of Typical Block in Sanan Oilfield, Daqing	
T. Li, Z. Li and J. Wang	348
Research on Column Flotation of Sliming Molybdenum Tailings Using Ultrasonic Pre-Treatment	
L. Cao	354
The Structural Characteristics and Distribution of Sand Body of the Layer 7 of YanChang Formation in Ordos Basin	
Q.Q. Lv, S.S. Luo, L.J. Li, R. Dai and Y.D. Li	360
Fault Activity's Controlling Effect on Source Rock an Example from Bohai Sea Area	
G.Z. Wang, Z.P. Wu, C. Liu and Y. Hu	366
Hydrocarbon Accumulation Dominant Factors and Modes of Minghuazhen Formation in Chengdao Area	
Y. Hu, Z.P. Wu and G.Z. Wang	372
Characteristics of Deep Abnormal High Pressure and its Controlling on Hydrocarbon Accumulation in Zhanhua Sag	
Q.H. Shi, B. Xia, Z.F. Wan and Y.J. Yuan	376
Prediction of Classification of Rock Burst Risk Based on Genetic Algorithms with SVM	
Y.H. Peng, K. Peng, J. Zhou and Z.X. Liu	383
Reservoir Dynamic Study in BZ 13-1 Oilfield	
G.B. Duan, Q.Z. Li, Q. Wang and L.Y. Ni	390

VRLA Battery SOH Estimation Based on WCP SO-LVSVM	
H.M. Zhuang and J. Xiao	396
Introduction and Exploration of Qualification on Prototype Series of Nuclear Classified Heat Exchanger Tubes of RCC-M Specification	
D.P. Huang, S.J. Zhang and Z. Liu	401
Standard Requirements and Localization Development Trend for Nuclear Power Plant Key Components Material	
S.J. Zhang, Y.Q. Kan and D.P. Huang	406

Chapter 5: Industrial Engineering and Information Technology

Research on Radical Innovation Technology Forecasting Based on Technology Evolution Theory	
E.S. Ping, R.H. Tan, F. Liu and B. Han	413
Research of Cloud Manufacturing Execution Path Optimization Based on Adaptive Ant Colony Algorithm on Hadoop Platform	
Z.G. Chen	417
Research of Virtual Assembly Simulation System	
L.B. Zhou, F.L. Xu and Z.X. Shen	421
The Research of Point Cloud Data Processing Technology	
L.B. Zhou, F.L. Xu and S.H. Liu	426
Displacement Measuring Method of Flexible Boom Based on MATLAB Video Processing	
S. Cao and Y.P. Luo	432
Soft-Sensing Model of Flatness Error on the Surface of Machining Workpiece and its Application	
J.P. Lei and J.M. Chen	436
Keyword Index	443
Author Index	447

CHAPTER 1:

Materials Science and Technologies