Frontiers in Mechanochemistry and Mechanical Alloying

Editors

Rakesh Kumar
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Foreword

I am very happy, that the tradition of INCOME continues, and the sixth conference in the series, which like all previous meetings attracted large number of people from all over the world, was successfully held at National Metallurgical Laboratory, Jamshedpur, India during December 2008. To me, hosting of INCOME2008 in India was special – India represents a country of great thinkers and scientists which is developing presently very dynamically its industry and technology; a country which I respect and admire, and in which I always felt at home when I was younger and could travel. I find it as a very important sign that mechanochemistry has become popular in the most rapidly developing countries. I find it as an equally important sign that INCOME2008 was hosted in India, the country, where people always tried to understand the Nature and its phenomena very deeply. Mechanochemistry is not only a promising tool to solve practical problems, Mechanochemistry is a serious scientific discipline, which requires fundamental approaches and new ideas.

Since the first International Meeting on Mechanochemistry in the USSR in 1968, since the first INCOME organized by Klara Tkacova in Slovakia in 1993, Mechanochemistry has conquered the scientific world. It is no longer a Cinderella at the Party for other Sciences, it is no longer an Ugly Duckling Science – it has become a beautiful Swan. In my opening message to the INCOME2003 in Braunschweig I focused on three main problems, which I find the most important for the progress of mechanochemistry – paying proper attention to the fundamental aspects of research, developing various types of apparatuses specially adapted to different types of mechanical treatment required for different processes, educating and training people in the field of mechanochemistry. I am very happy that INCOME2008 touched upon some of these issues in a comprehensive and much focused way through the organization of a number of thematic sessions. It gives me great pleasure that the Indian colleagues have made an extra effort to publish the submitted papers in the form of a book, ‘Frontiers in Mechanochemistry and Mechanical Alloying’. The thematic structure of the conference is retained in the book which I believe would certainly be helpful in identifying current trends and focus. The book, a useful compilation of papers, would serve as an important reference for the researchers and engineers in the field.

Novosibirsk, 
Vladimir Boldyrev
November 18, 2011
Preface

Since the classical papers on mechanical activation of solids by Carey Lea over hundred years back (1893-94), mechanochemistry and mechanical activation has come a long way and evolved as a frontier area of research and applications in the last two to three decades. The cornerstones of the growth of this field have been enhanced fundamental understanding, widening of the spectrum of applications encompassing newer materials and processes and, design and development of new equipment and devices. The areas of applications of mechanochemistry have expanded exponentially and today it encompasses all facets of metallurgy, including metal extraction, alloying, composites, mechanical metallurgy, traditional and advanced ceramics processing, pharmaceuticals, utilization of wastes, energy and environment, and many more. The INCOME series of conferences initiated by the International Mechanochemistry Association [an associate member of International Union of Pure and Applied Chemists (IUPAC)] has served as a common platform to bring together all stakeholders from academia, Research and Development organizations, and industry to foster the growth of the discipline. The first international conference on ‘Mechanochemistry and Mechanical Alloying (INCOME1993)’ was held in Košice (Slovakia) in 1993. This was followed by INCOME1997 in Novosibirsk (Russia), INCOME2000 in Prague (Czech Republic); INCOME2003, in Braunschweig (Germany), and INCOME2006 again in Novosibirsk.

The sixth conference in the series, INCOME2008, was held at Jamshedpur (India) during December 1-4, 2008. It is interesting to note that the perception about Mechanochemistry as a scientific discipline has changed over these years as reflected by the words of Prof. V.V. Boldyrev, the founding president of IMA ...

“... It (mechanochemistry) is no longer a Cinderella at the Party for other Sciences, it is no longer an Ugly Duckling Science – it became (has become) a beautiful Swan....”

and those of the current President, Prof. Mamoru Senna,

“Are you confident to write a winning proposal with “mechanochemistry” as a central keyword?”...I personally feel to reconsider, how and why mechanical stressing on a particular set of materials is indispensable and valuable? Reply to this question can be and must be manifold”

While there are genuine concerns in some cases, the fact also remains that stressing of solids is perhaps the only answer to novel processes and materials development in many cases. INCOME2008 stimulated interesting debate on several of these issues.

The hosting of the Conference in India was not a mere coincidence. In line with the international developments, in India, the activities in the area of mechanical alloying were initiated at Indian Institute of Science, Bangalore, nearly two to three decades ago, and later spread over to several other institutions covering important facets of the discipline. The National Metallurgical Laboratory at Jamshedpur has been the torch bearer for mechanochemistry at least since 2000, when a major programme on metal extraction processes and waste utilization/minimization strategies, requiring application of mechanical activation on a large scale, was taken up.
A marked deviation between INCOME2008 and the previous INCOMEś has been the introduction of thematic sessions. The sessions included: Mechanochemistry of Macromolecules and Applications in Pharmaceuticals, Nano-particle and Nano-composites, Advance Ceramics Science and Technology, Severe Plastic Deformation and Friction Stir Welding; Mechanical Alloying and Advanced Materials, Mineral Processing and Extractive Metallurgy and, Building Materials and Environment Management. About hundred and fifty papers were presented in the conference under various themes. Abstracts of these papers were made available to the participants during the conference. This book, ‘Frontiers in Mechanochemistry and Mechanical Alloying’ is a compilation of select papers for which full manuscripts were received. The papers were peer reviewed and edited to the extent possible. The original thematic structure of the conference is retained in the book. While a clear cut demarcation in terms of themes is not possible, the structuring has certainly helped to bring in focus.

We, the editors, would like to thank several of our colleagues whose cooperation and support made it possible to bring out this edited volume. The patronage of Academician V.V. Boldyrev (Founding President IMA), Prof. Mamoru Senna (President, IMA) and Prof. Samir K. Brahmacari (Director General Council of Scientific and Industrial Research (CSIR)) is gratefully acknowledged. Profs. Nikolai Z. Lyakhov, Elena V. Boldyreva, Peter Baláž, K. Anantha Padmanabhan, Gabriele Mulas and Thierry Grosdidier supported us in all possible ways to complete this book. We are grateful to all our colleagues who rendered support for review, editorial assistance and composing. The assistance received from NML colleagues, especially, Dr. Soumitro Tarafdar (Materials Division), Dr. Sanjay Kumar, Mr. T.C. Alex (Mechanochemistry and Reactivity Group), Dr. N.G. Goswami (Information Management and Dissemination Division) and Mr. Nimai Halder (Engineering Division) is gratefully acknowledged.

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CONTENTS

Mechanochemistry of Macromolecules and Applications in Pharmaceuticals

MECHANOCHEMISTRY OF ORGANIC SOLIDS: WHERE ARE WE NOW? 17
E. Boldyreva

DEVELOPMENT OF LIQUID-ASSISTED GRINDING FOR THE SYNTHESIS OF HYDROGEN-BONDED AND COORDINATION FRAMEWORKS 31
T. Friščić, W. Jones

ON THE EXISTENCE OF A DYNAMIC CRITICAL POINT BY USING WET MILLING ON (±) MODAFINIL 41
Julie Lino, Pauline Martinetto, Michel Anne, Gérard Coquerel

MECHANOCHEMISTRY AND SOLUBILIZATION OF DRUGS 45
T.P. Shakhtshneider, V.V. Boldyrev

THE MECHANICAL TREATMENT AS A METHOD OF INORGANIC SUBSTANCES PASSIVATION 50
N. Kosenko, L. Vinogradova, N. Filatova, M. Smirnova

NOVEL TITANIUM - HYDROXYAPATITE BIOCOMPOSITES BY MECHANICAL MILLING 59
A. Thirugnanam, N. Veera Chakravarthi, Uday Chakkingal, T.S. Sampath Kumar

Nano-particle and Nano-composites

ON THE PROCESSING OF DENSE HETERO-NANOSTRUCTURED METALLIC MATERIALS FOR IMPROVED STRENGTH / DUCTILITY BALANCE BY ECAE AND SPS METHOD 65
T. Grosdidier, G. Ji, N. Llorca
CRYSTALLITE SIZE DEPENDENT CATION DISTRIBUTION IN NANOSTRUCTURED SPINELS STUDIED BY NMR, MÖSSBAUER SPECTROSCOPY AND XPS
V. Šepelák, I. Bergmann, S. Indris, P. Heitjans, K.D. Becker

ESTIMATION OF MECHANOChemICAL EFFECTS IN HETEROGENEOUS PROCESSES
G. Mulas, F. Delogu

production and stability of Ai and Cu ultrafine particles in nanoFLUIDS
S. Samal, D. Chaira, B. Satpati

Ball milling effect on the properties of Ultra high molecular weight polyethylene - bronze composite
V.V. Tcherdyntsev, S.D. Kaloshkin, V.A. Sudarchikov, A.A. Dorofeev, I.V. Mochkina, N.V. Yuryeva, V.D. Danilov

structure and properties of ball milled ultra high molecular weight polyethylene - clay composite
S.D. Kaloshkin, K.S. Ergin, E.M. Antipov, V.A. Gerasin, V.V. Tcherdyntsev, A.V. Maksimkin, M.I. Petzhik

Advance Ceramics Science and Technology

Mechanochemical synthesis, characterization and photocatalytic properties of M₂O₃/TiO₂ (M = Fe, Mn) nanocomposite under visible light
Tanmay K Ghorai, Panchanan Pramanik

Novel transport properties of nanostructured α-Fe₂O₃
P.Brahma, S. Dutta

Synthesis and characterization of nanocrystalline carbides by reaction milling
D. Chaira, B.K. Mishra, S. Sangal

Effect of mechanical activation on the in-situ production of Fe-TiC composite
S. Moradi, Sh. Raygan

Synthesis of nanostructured titanium carbide from titanium oxide and ferrotitanium through mechanical activation
Malek Ali, Projjal Basu

Mechanochemical conversions of acetylene in quartz – ultrafine metal powder system
V.G. Surkov, A.K. Golouko, O.I. Lomovsky, J.S. Lobanov

Mechanochemical synthesis of nanocrystalline lead selenide
M. Achimovičová, P. Baláž, J. Ďurišin, A. Rečnik, J. Kováč, A. Šatka, A. Feldhoff, E. Gock
Severe Plastic Deformation and Friction Stir Welding
ULTRAFINE GRAINED MATERIALS THROUGH MECHANICAL PROCESSING: AN ASSESSMENT
K. A. Padmanabhan, S. Balasivanandha Prabu
SPECIFICS OF MECHANICALLY DRIVEN ATOMIC DISTRIBUTIONS IN INTERSTITIAL ALLOYS
J. Focot
THE MICROSTRUCTURE, TEXTURE AND MECHANICAL PROPERTIES OF AS-ECAE INTERSTITIAL-FREE STEEL AND COPPER
Azdiah A. Gazder, Florian H. Dalla Torre, Christopher H.J. Davies, Elena V. Pereloma
MICROSTRUCTURE AND TEXTURE EVOLUTION OF PURE MAGNESIUM DURING ECAE
Somjeet Biswas, Satyaveer Singh D., Satyam Suwas
EVALUATION OF INTERFACE MICROSTRUCTURE FOR FRICTION STIR WELDED ALUMINIUM-STAINLESS STEEL PLATE

Mechanical Alloying and Advanced Materials
SYNTHESIS OF NANOCRYSTALLINE AND AMORPHOUS PHASES IN COMPLEX METALLIC ALLOYS DURING MECHANICAL MILLING
N.K. Mukhopadhyay
MECHANICALLY ALLOYED MAGNESIUM-BASED MATERIALS FOR HYDROGEN STORAGE
I. Konstanchuk, K. Gerasimov, J.-L. Bobet
MECHANICAL ALLOYING OF Al-C SYSTEM
Michal Besterci, Katarína Sülleiová, Oksana Velgosová
INTERMETALLIC COATINGS PRODUCED BY MECHANICAL ALLOYING METHOD
Sergey Kaloshkin, Sergey Romankov, Sergey Komarov, Ekaterina Kaevitser
MECHANICALLY INDUCED PHASE TRANSFORMATION IN Al-Cu-Fe-Cr DECAGONAL QUASICRYSTALLINE ALLOY BY HIGH-ENERGY BALL MILLING
T.P. Yadav, N.K. Mukhopadhyay, R.S. Tiwari, O.N. Srivastava
PHASE TRANSFORMATIONS IN MECHANICALLY ALLOYED Al-Cu-Cr POWDERS
V.V. Tcherdyntsev, A.P. Shevchkov, T.A. Sviridova, S.D. Kaloshkin
IN-SITU FORMATION OF NbC IN MECHANICAL ALLOYED Cu-Nb-C AT DIFFERENT TEMPERATURE
Z. Hussain, M. Yusoff
THE MAGNETIC BEHAVIOR OF Cu-Ni-Co-Fe QUATERNARY ALLOYS PREPARED BY MECHANICAL ALLOYING
B.N. Mondal, A. Basumallick, P.P. Chattopadhyay

COMPOSITION DEPENDENT PROPERTIES OF MECHANICALLY ALLOYED AMORPHOUS Fe-Zr-B POWDERS
Debabrata Mishra, A. Perumal, A. Srinivasan

EFFECT OF COMPACT DENSITY AND PREHEATING TEMPERATURE OF THE Al-Ti-C PERFORM ON THE FABRICATION OF IN-SITU Mg-TiC COMPOSITES
A.K Chaubey, B.K. Mishra, N.K. Mukhopadhyay, P.S. Mukherjee

DEVELOPMENT OF 2024 P/M ALUMINIUM ALLOY- SiCp NANOCOMPOSITES VIA MECHANICAL ALLOYING
Sandeep Kumar Chauhan, P.R. Soni

STRUCTURE AND MAGNETIC PROPERTIES OF MECHANICALLY ALLOYED Fe₃₋ₓAlₓCrₓ POWDERS

Mineral Processing and Extractive Metallurgy

APPLIED MECHANOCHEMISTRY OF SOLIDS (A REVIEW)
P. Baláž, Erika Dutková

WHERE DOES THE ENERGY GO IN HIGH ENERGY MILLING?
C. Sasikumar, S. Srikanth, Rakesh Kumar, T.C. Alex, S.P. Mehrotra

MECHANOCHEMICAL RACTIONS OF CLAY MINERALS WITH CsCl
S. Yariv, I. Lapides, E. Abramova

CHANGES IN THE STRUCTURE OF TALC BY CONTINUOUS JET MILLING IN RELATION TO IMPOSED SPECIFIC KINETIC ENERGY
Samayamuthirian Palaniandy, Khairun Azizi Mohd Azizli, Hashim Hussin, Syed Fuad Saiyid Hashim

INCREASING GAS SORPTION ONTO CARBON BY MILLING WITH ALUMINA
N.J. Welham, N. Setoudeh

INFLUENCE OF MECHANICAL ACTIVATION ON ALKYLATION AND EXTRACTABILITY OF COAL
M.P. Kulikova, Yu.D. Kaminskii

BIO-DISSOLUTION OF METALS FROM ACTIVATED NODULES OF INDIAN OCEAN
K.D. Mehta, Rakesh Kumar, B.D. Pandey, S.P. Mehrotra

STUDY OF THE SILVER IONS CEMENTATION AFTER MECHANICAL ACTIVATION OF CEMENTATOR
Martin Fabián, Peter Baláž, Jaroslav Briančín
INFLUENCE OF THICKNESS OF COATED LAYER ON PARAMETERS AND KINETICS OF MECHANICAL ACTIVATION (EXAMPLE OF QUARTZ PROCESSING)
T. Ketegenov, F. Urakaev

<table>
<thead>
<tr>
<th>Building Materials and Environment Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENHANCING THE POTENTIAL OF INDUSTRIAL USE OF THE INDIAN FLY ASHES THROUGH MECHANO-CHEMICAL ACTIVATION -- PROSPECTS AND PROBLEMS</td>
</tr>
<tr>
<td>A.K. Chatterjee</td>
</tr>
<tr>
<td>MECHANICAL ACTIVATION IN BLENDED CEMENT PROCESSING</td>
</tr>
<tr>
<td>Rakesh Kumar, Sanjay Kumar, S.P. Mehrotra</td>
</tr>
<tr>
<td>PRODUCTION AND PRACTICAL APPLICATION OF MECHANICALLY ACTIVATED FLY ASH-BASED BINDING MATERIAL</td>
</tr>
<tr>
<td>B. Csőke, G. Mucsi, Cs. Sík</td>
</tr>
<tr>
<td>MECHANOSORPTION OF CO2 BY SILICATES: MECHANISM, KINETICS AND POSSIBLE APPLICATIONS</td>
</tr>
<tr>
<td>A.M. Kalinkin</td>
</tr>
<tr>
<td>A POSSIBLE WAY TO STORAGE CARBON DIOXIDE ON MECHANICALLY ACTIVATED OLIVINE (Mg, Fe)2SiO4</td>
</tr>
<tr>
<td>Erika Turianicová, Peter Baláž</td>
</tr>
<tr>
<td>GEOPOLYMERS, FLY ASH REACTIVITY AND MECHANICAL ACTIVATION</td>
</tr>
<tr>
<td>Sanjay Kumar, Rakesh Kumar, S.P. Mehrotra</td>
</tr>
<tr>
<td>UTILIZATION OF FERROUS-MAGNESIUM SLAG FOR PRODUCTION OF BINDING MATERIALS</td>
</tr>
<tr>
<td>B.I. Gurevich, A.M. Kalinkin, V.V. Tyukavkina, E.V. Kalinkina, V.T. Kalinnikov</td>
</tr>
<tr>
<td>MINING WASTE UTILIZATION IN THE PRODUCTION OF BUILDING MATERIALS</td>
</tr>
<tr>
<td>V.T. Kalinnikov, O.N. Krasheninnikov, T.P. Belogurova</td>
</tr>
</tbody>
</table>

AUTHORS INDEX

KEYWORDS INDEX