

Editors' Note

Technological and scientific challenges coupled with environmental considerations have prompted a search for simple and energy-efficient synthesis and processing routes of materials. Among the many types of preparation and processing techniques, the non-conventional mechanochemical route has been recognized as a powerful method for the production of novel, high-performance, and low-cost materials. Correspondingly, terms such as mechanochemistry, mechanical activation, mechanical alloying, high-energy milling, mechanochemical processing, or various variants, are becoming increasingly common in the materials science and condensed matter physics and chemistry literature. Thus, mechanochemistry, defined as a branch of science dealing with physico-chemical transformations and chemical reactions of solids induced by mechanical action, is the subject of increasing interest for theoretical as well as application-oriented reasons. A better understanding of processes in the realm of the mechanochemistry is expected to open new directions in the preparation of functionally tailored materials and to lead to the improvements in various industrial processes.

The International Conference on Mechanochemistry and Mechanical Alloying (INCOME 2003), held from 7th to 11th September 2003 in Braunschweig, Germany, was focused on the latest development in the field of mechanochemistry and mechanical alloying. It was the fourth conference in the series of INCOME since 1993. The conference series began to provide a forum for exchange of ideas and results among the ever increasing numbers of the mechanochemistry and mechanical alloying community. The first INCOME, held in 1993 in Kosice (Slovakia) was a nucleus, whose remarkable growth has culminated in the establishment of regular, well-attended meetings (1997, Novosibirsk, Russia; 2000, Prague, Czech Republic; 2003, Braunschweig, Germany).

The philosophical bent of the organizers of INCOME 2003 was to offer a multi-disciplinary forum for exchanging information and novel ideas about mechanochemistry, mechanical alloying and related properties and behavior of materials in an essentially non-formal environment. The conference was hosted by the Technical University of Braunschweig (the oldest Technical University in Germany) and supported by the Deutsche Forschungsgemeinschaft, the State of Lower Saxony, and by the Braunschweigische Hochschulbund.

INCOME 2003 was organized in two sections. One hundred ninety participants from 40 countries of 6 continents listened to 7 plenary, 27 keynote, and 69 lectures. During the conference 176 posters were presented. The International Referee Panels recommended a total 105 papers to be published in this Special Issue of the Journal of Materials Science. Thus, the present Issue represents a state-of-the-art overview of the worldwide activities in mechanochemistry and mechanical alloying. Contributions present recent results in traditional and novel subjects of mechanochemistry and mechanical alloying, especially:

- *Mechanochemical Reactions and Processing in Solid-State Science and Technology*: All types of mechanochemical reactions (e.g., Mechanochemical synthesis, Self-sustained high-temperature synthesis (SHS) induced by milling, Mechanochemical redox reactions, etc.); Mechanical alloying (including hydrogen storage alloys); Mechanical activation; High-energy milling; Pressure-induced structural transformations in solids; Mechanochemistry of inorganic solids; Mechanochemistry of organic substances.
- *Mechanisms of Mechanochemical Reactions; Thermodynamics and Modeling*: Fundamentals and models of mechanically stimulated processes; Fundamental problems of the mechanical action on solid; Computer simulations.
- *Structural Characterization*: Mechanically induced structural changes in solids; Role of defects (point defects, dislocations, clusters, precipitates, grain boundaries); Defects at surfaces and interfaces; Characterization using spectroscopic techniques (Mössbauer spectroscopy, EXAFS, etc.).
- *Properties*: Chemical, electrochemical, electrical, magnetic, electronic, optical, tribological, thermal, mechanical, etc.
- *Near and Long-Term Applications and Technological Challenges*: Preparation and characterization of active powders; Equipments and experimental procedures.

Materials classes covered include both inorganic and organic substances, metastable crystalline, quasicrystalline and amorphous phases and various geometries and nanostructures, including nanocrystalline materials and nanosized particles (e.g., metals, alloys, halides, oxides, sulfides, nitrides, carbides, diamond, II–IV compounds, etc.). All the main aspects of these materials are covered, including synthesis, microstructure, properties and performance.

MECHANOCHEMISTRY AND MECHANICAL ALLOYING 2003

We trust that the research described within this Special Issue of the Journal of Materials Science will stimulate further activities and generate new directions in this multidisciplinary field of synthesis and processing.

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