

## Seminar Series

Sponsored by

School of Materials Science and Engineering

Wednesday, November 26, 2008

11:00 AM – Room 260 Surrine Hall

### Organic Mechanochemistry – Scientific Trick or Tricky Science?

*Dr. Viktor Balema, Sigma-Aldrich Co.*

#### Abstract

During the last decade, milling and grinding have been developed from simple materials processing techniques into powerful synthetic tools that facilitate chemical reactions between organic or inorganic solids without solvents. Such solvent-free chemical transformations are commonly known as *mechanochemistry*, reflecting the crucial role of mechanical treatment in the process. As a rule, mechanochemical reactions are carried out by grinding solid reactants in a mortar with a pestle or by milling them in commercially available ball-mills. The products of mechanochemical transformations form in high yields, and require little or no purification. The mechanochemical approach has been successfully used to performing both stoichiometric and catalytic solvent-free reactions, as well as to carry out multi-step transformations as one-pot processes. It significantly reduces the waste stream of hazardous materials and demonstrates an excellent atom economy, thus, satisfying major requirements for green chemical processing. Overall, solvent-free mechanochemistry is an environmentally friendly chemical tool with an excellent potential to become an enabling technique for green chemistry. The talk discusses most recent advances in the area of mechanochemistry of organic and molecular solids including mechanisms of mechanochemical reactions.



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Dr. Viktor Balema is a recognized authority on the solvent-free mechanochemistry of organic and molecular solids. His pioneering research on the mechanically induced solvent-free Wittig reaction was featured by *New Scientist*, *Scientific American* and *Science Magazine* in 2002. An invited review contribution on mechanically facilitated transformations of organic and organometallic solids, co-authored by Dr. Balema, will appear in *Chemical Reviews* in 2009. Dr. Balema serves as a review panel member for the U.S. Department of Energy, the U.S. Civilian Research and Development Foundation (CRDF) and the Petroleum Research Fund. Currently, he is a Product Manager responsible for innovations in several areas of Materials Science at Sigma-Aldrich Corp. He also acts as an Editor for the *Material Matters* – a technical periodical published by the Materials Science division of Sigma-

Dr. Balema graduated with MS degree in Chemistry from Lviv National State University (Ukraine) in 1983. Then, he received PhD degree from Nesmeyanov Institute of the Russian Academy of Science in 1990. Dr. Balema completed Post. Doctoral Studies with Prof. Fritz at the University of Karlsruhe, Germany 1993. Before joining Sigma-Aldrich Corp. in 2003, V. Balema served as Visiting Scientist at the University of Leipzig, Germany and as Associate Scientist at the Ames Laboratory of the US Department of Energy. Dr. Balema is the author of over 70 publications.