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SCHOOL OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF MECHANICAL ENGINEERING
Purdue School of Engineering and Technology

FALL 2008 SEMINAR SERIES

Date: Thursday, September 18, 2008
Time: 11:00 am – 12:00 pm
Room: SL 165

Everyone is invited

Combustion of Metals for Mars Propulsion and Fuel Cell Applications

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Abstract.
Since 1950s, combustion of metals has been studied by many researchers for applications to solid rocket propellants, explosives and pyrotechnics. This seminar will cover the innovative effort for developing new, non-traditional technologies where combustion of metals plays the key role.

The concept of metal/CO_2 propulsion on Mars is based on the ability of metals, such as magnesium and aluminum, to burn with carbon dioxide and suggests use of the Martian CO_2 as an oxidizer in jet or rocket engines with metals as fuel. Performance characteristics of metal-CO_2 rocket engines and analyses of Mars missions with these engines will be presented, along with the results of fundamental studies on combustion of Mg and Al particles in carbon oxides, as well as on ignition of coated Al particles.

The second part of the talk will focus on the new methods to generate hydrogen for fuel cell applications, which involve boron compounds, metal (Al or Mg) and water. In the proposed mixtures, the highly exothermic reactions of metal particles with water assist dehydrogenation of boron compounds, eliminating the need for catalyst. Upon ignition, such mixtures exhibit self-sustained combustion wave propagation with simultaneous release of hydrogen stored in boron compounds and water.

About the Speaker.
Evgeny Shafirovich received PhD in Physics (1988) from the Institute of Chemical Physics, Russian Academy of Sciences. He holds a MS in Mechanical Engineering from the Moscow Aviation Institute. Prior to joining Purdue as a research scientist in April 2004, he conducted research at the Russian Academy of Sciences (Chernogolovka), University of Notre Dame (IN), and CNRS (Orléans, France). His research interests include combustion of metals, energetic and gas-generating materials, hydrogen storage and portable power, coal gasification and combustion, and Mars *in situ* resource utilization.