Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Energy Science Center

Institute of Energy Technology – Professorship of Renewable Energy Carriers

Invitation to a Seminar

Date: Wednesday, Feb. 22, 2012

Time: 16:00-17:00

Place: Maschinenlaboratorium ETH Zürich, ML-J25/26

Speaker: **Prof. James Klausner**
Department of Mechanical and Aerospace Engineering
University of Florida, Gainesville, USA

Title:

High Temperature Thermochemical Conversion: Coal to Hydrogen and Sunlight to Fuel

Abstract – It is well known that the amount of solar energy striking a 500×500 kilometer portion of the earth is sufficient to meet the current energy demand of the entire planet. As such, the U.S. National Academy of Engineering has cited the economical capture and utilization of solar energy as one of the National Grand Challenges. Making fuels from sunlight is one of the strategic goals in the Department of Energy's report, *New Science for a Secure and Sustainable Energy Future*. Because solar energy is an intermittent power source and the most suitable locations for solar power collection are desert regions and generally away from urban centers, it is essential that solar energy collection be coupled with energy storage technologies to be economical. Numerous storage solutions are being pursued, but the chemical storage of solar energy as a fuel is a superior concept due to the high energy density and the existing global infrastructure for fuel transport and storage. This talk will discuss a novel dual cavity, windowless, high temperature chemical reactor that converts concentrated solar thermal energy to Syngas, which is currently under development at the University of Florida. The cost effective, solar thermochemical production of Syngas, using an iron-based non-volatile metal oxide looping processes as a precursor for clean and carbon neutral synthetic hydrocarbon fuels such as methanol, methane, or synthetic petroleum, is the overarching project goal. The reactor uses water and recycled CO2 as the sole feed-stock and concentrated solar radiation as the sole energy source. Thus, the solar fuel is completely renewable and carbon neutral. A highly reactive, high surface area iron-based porous structure has been synthesized using a magnetically stabilized bed sintering technique. A hybrid reactor kinetic model has been developed and validated over a number of cycles in laboratory scale reactors. A 5000 sun solar simulator has been developed as an energy driver for the thermochemical reactions. Ongoing work involving the high temperature looping process to convert coal to hydrogen will also be considered.

Biosketch –.
Ph.D. 1989, University of Illinois Urbana-Champaign. Prof. Klausner has been widely recognized for his fundamental research in multiphase flow and boiling heat transfer. He serves on the editorial board of the *International Journal of Heat and Fluid Flow* and has authored over one hundred publications in the thermal sciences. He is leading a research project aimed at conversion of concentrated solar energy to fuels. A major research initiative launched over the past several years is the development of a waste heat driven desalination process for which a patent has been issued. In addition, Dr. Klausner is the founder of the Gainesville Conductive Education Academy, a school for children with profound neurological disabilities. Dr. Klausner has been awarded the SAE Ralph Teetor Educational award and the University wide TIP teaching award. He has served as Chair of the ASME Heat Transfer Division Committee, Heat Transfer in Multiphase Systems and currently serves as Chair of the ASME Heat Transfer Division Executive Committee. He is an ASME Fellow.

Host: Prof. A. Steinfeld, www.pre.ethz.ch