PHOTOBIOLOGICAL HYDROGEN PRODUCTION

Prof. Laurent Pilon
University of California, Los Angeles
Mechanical and Aerospace Engineering Department
www.seas.ucla.edu/~pilon/
Hosted by Prof. Daniel Attinger

Industrial and developing nations are facing an unprecedented combination of economic, environmental, and political challenges. First, they face the formidable challenge to meet ever expanding energy needs without further impacting climate and the environment. Second, the continued population growth in developing countries and the emergence of a global economy are creating unprecedented stress on the resources of the Earth. Emerging countries are claiming access to the same standard of living of industrial nations, resulting in large needs for energy sources, fast and reliable transportation systems, and industrial equipment. From the standpoint of international security, energy issues include the potential for conflict over access to remaining supplies of inexpensive fossil fuels often concentrated in politically unstable regions. Consequently, the growing energy needs necessitate much greater reliance on a combination of fossil fuel-free energy sources and on new technologies for capturing and converting CO_2.

Hydrogen offers an alternative as an energy carrier for stationary and mobile power generation. It has a large gravimetric energy density and its oxidation with oxygen in fuel cells produces only water vapor. Unfortunately, 96% of hydrogen is currently produced from fossil fuels. Photobiological hydrogen production by cultivation of photosynthetic microorganisms offers a clean and sustainable alternative to thermochemical or electrolytic production technologies with the added advantage of CO_2 mitigation.

This seminar presents photobiological hydrogen production by *Anaebena variabilis* and wild and genetically modified *Chlamydomonas reinhardtii* with reduced pigment concentrations. Design, instrumentation, operation, and performances of an instrumental photobioreactor are described. The effects of genetic engineering on the radiation characteristics of *C. reinhardtii* are quantified experimentally. Finally, simulations of light transfer through photobioreactors and scale-up challenges are discussed.

Laurent Pilon received his B.S. and M.S. in 1997 in Applied Physics from the Grenoble Institute of Technology, France. He worked for two years for the French Atomic Energy Commission before starting his doctoral studies at Purdue University. He graduated in 2002 with a PhD in Mechanical Engineering. He then, joined the Mechanical and Aerospace Engineering Department at UCLA where he is Associate Professor. He is the recipient of the 2005 National Science Foundation CAREER Award, and the 2005 Northrop Grumman Excellence in Teaching Award from the UCLA School of Engineering and Applied Science, and the 2008 Bergles-Rohsenow Young Investigator Award in Heat Transfer from the American Society of Mechanical Engineers (ASME).