Solar Thermal Decarbonization by Catalytic Moving Bed Particle Reactors

by

Prof. Justin Lapp

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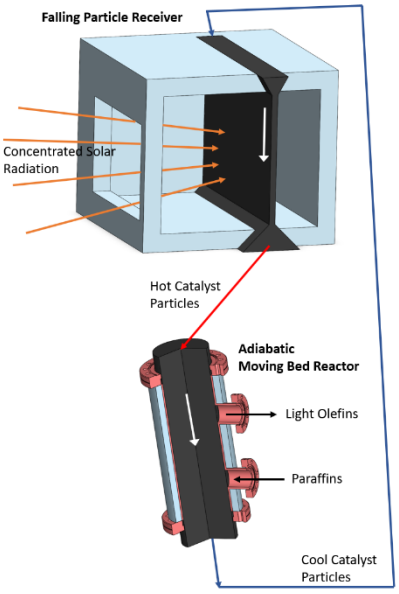
Abstract – The industrial production of chemicals and materials is responsible for over a third of global energy consumption. Much of this energy is provided by fossil fuels in the form of high temperature heat. Concentrated sunlight can provide a renewable path to providing heat at high temperatures, but it can be challenging to integrate a continuous, controlled, industrial process with solar energy. The group of Dr. Justin Lapp at the University of Maine have been investigating the coupling of solar energy with a 600°C+ catalytic dehydrogenation of propane for producing plastic precursors. In this talk, Dr. Lapp will share the comprehensive research effort to develop a reactor system where catalyst particles are heated directly by sunlight and carry heat to a moving bed counter-flow heat exchanger-reactor. The team has investigated fundamental chemical kinetics and catalyst design, process thermodynamics, solar absorption by catalyst particles, and designed a lab-scale prototype reactor. The team has also developed novel high-fidelity numerical simulations combining particle physics, fluid mechanics, and multi-mode heat transfer. The overall concept and development approach will be shared as a model which can be applied to incorporate solar thermal energy for other energy intensive industrial processes.



Dr. Justin Lapp is an Assistant Professor of Mechanical Engineering at the University of Maine, in Orono, Maine, USA. He holds a Ph.D. from the University of Minnesota and is a former research scientist at the German Aerospace Center. His research group, the Solar Thermal Energy Laboratory, focuses on high temperature heat transfer, energy systems, and high-temperature industrial applications of solar energy.

Host: Prof. Aldo Steinfeld, Renewable Energy Carriers

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