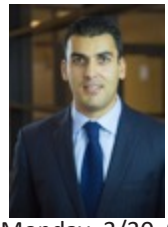
Material Paradigms for Full-Spectrum Solar Energy Harvesting and Storage



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Monday, 3/30, 9:55 am
Zoom Meeting
https://zoom.us/j/884251297?pwd=N1RjOGY4eGxBTmNxWUNFVHl2L0ZLQT09
Meeting ID: 884 251 297; Password: 080807

LECTURE ABSTRACT

Recently, solar heat localization concept has provided an appealing route for efficient utilization of solar thermal energy. This concept has shown remarkable promise in power generation, desalination, distillation, water splitting, sterilization, oil spill cleanup, electricity generation from salinity and also CO_2 capture.

In this talk, we discuss the physics of molecular energy and latent heat storage to introduce an *integrated* harvesting and storage hybrid paradigm for potential 24/7 energy delivery. The hybrid paradigm utilizes heat localization during the day to provide a harvesting efficiency of 73% at small-scale and ~90% at large-scale. Remarkably, at night, the stored energy by the hybrid system is recovered with an efficiency of 80% and higher temperature than that of the day, in contrast to all the state-of-the-art systems. The integrated hybrid concept and the system open a path for simultaneous harvesting and storage of solar-thermal energy for a wide range of applications.

Furthermore, we report a solid-state sustainable CO_2 collector (SCC), which is activated by solar heat localization. This stable cyclic SCC is based on ionic liquids and graphene aerogel, which undergoes solid-liquid phase change to efficiently capture and convert CO_2. The SCC captures 0.2 moles of CO_2 for every mole of ionic liquid and converts the absorbed CO_2 into useful byproducts, including water and calcium carbonate in each cycle. A system prototype of the SCC is developed and demonstrated. The SCC provides a new and promising paradigm to efficiently capture and convert CO_2 using abundant solar energy to address global emissions and consequent environmental challenges.

SPEAKER BIOSKETCH

Hadi Ghasemi is Cullen Associate Professor in the Department of Mechanical Engineering at the University of Houston and director of Nanotherm research group. He received his PhD degree in 2011 from the University of Toronto. He continued his studies as a Postdoctoral Associate at Massachusetts Institute of Technology (MIT) from 2012 to 2014. He is the recipient of the several awards in the field of heat transfer and surface physics including Early Innovator Award, AFOSR Young Investigator Award, top three innovator award of NASA iTech, University Excellence Award and Russel Reynolds award in Thermodynamics. He was selected as one of the finalist for World Technology Award in the energy category in 2014. His research works are highlighted in Nature, Economists and Popular Science among others. His current research interests are in nanotechnology, surface physics and heat transfer.