IOWA STATE UNIVERSITY
Department of Mechanical Engineering

CO2 Capture by using Chemical Looping Combustion

Tariq Shamim

Mechanical and Materials Engineering
Masdar Institute of Science and Technology
Abu Dhabi, United Arab Emirates

Seminar on Thursday, March 2, 2017 at 2:00 pm in 2004 Black
Seminar host: Xianglan Bai
Please note this seminar begins at 2 pm, not 11 am

Abstract

A major source of emissions of carbon dioxide (CO2), a greenhouse gas that contributes to global warming, is the combustion of fossil fuels. Until zero-carbon energy sources such as nuclear and renewable energy technologies mature and become cost-competitive, the use of fossil fuels will remain wide spread and will probably grow with the expanding energy needs of the world's developing economies. Improved conversion and end-use efficiency, carbon-capture and storage are key strategies to limit CO2 emissions and accumulation in the atmosphere.

This talk describes our current research program on the investigation of an innovative combustion concept, chemical looping combustion (CLC), which offers a potentially attractive option to capture CO2 with a significantly lower energy penalty than other existing carbon-capture technologies, namely, pre-combustion, oxy-fuel combustion, and post-combustion. Contrary to a conventional combustion process, in CLC, the fuel and oxidizer are never brought in contact during the "combustion" process. Instead, the overall fuel combustion process is split into two separate reactions performed in two separate reactors: an oxidation reaction and a reduction reaction, accomplished by introducing suitable metal oxide as an oxygen-carrier that circulates between the two reactors. The main advantage of this approach is that the CLC-based energy conversion systems could achieve high thermodynamic efficiency while capturing most or all of the CO2 emitted during combustion. By comparing with other CO2 capture technologies, the talk will discuss the salient features and research issues of the CLC technology. Details and challenges of the CFD and systems level modeling approaches for CLC systems will be discussed. Results of the models will be presented to elucidate the importance of understanding the physicochemical processes in improving the design of the CLC reactors.

The talk will end with a brief overview of our research activities in energy storage and clean energy technologies.

Bio

Dr. **Tariq Shamim** is a Professor of Mechanical Engineering at the Masdar Institute of Science and Technology, Abu Dhabi, UAE. He earned his doctorate in mechanical engineering and a master's in aerospace engineering from the University of Michigan – Ann Arbor. He received a second master's in mechanical engineering from the University of Windsor, Canada. Prior to joining the Masdar Institute, Dr. Shamim was a tenured faculty member in the Department of Mechanical Engineering at the University of Michigan-Dearborn. He also held visiting faculty appointments at the Massachusetts Institute of Technology, National University of Singapore, American University of Sharjah, Oak Ridge National Laboratory and Ford Motor Company. Dr. Shamim specializes in the broad area of sustainability with special focus on clean energy technologies. His research and consulting work has been supported by several grants from the NSF, US Department of Defense, US Department of Energy, automotive, aerospace, and oil companies, and the government of Abu Dhabi. He is a fellow of the American Society of Mechanical Engineers, and is a recipient of several awards including the SAE International Ralph Teetor award for excellence in teaching (2004). He is currently serving as a Subject Editor of Applied Energy journal.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

www.me.iastate.edu