DEPARTMENT OF MECHANICAL ENGINEERING WILLIAM MAXWELL REED SEMINAR SERIES

"Chemical Looping Methane Thermo-catalytic Decomposition for Continuous High Purity Hydrogen Production with Activated Carbon Carrier"

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Abstract: Currently, the state of the art process used for hydrogen (H2) production is steam methane reforming. However, the H2 produced by this multiple-step method is unavoidably accompanied by a large amount of CO2 emission both from the process itself and the input energy for the process. Hence, if H2 combustion/utilization is to become the ultimate approach for producing clean energy, an urgent need exists to develop CO2-free H2 production technologies. The application of a chemical looping process to methane thermo-catalytic decomposition using activated carbon (AC) as a catalyst has been recognized as a promising technology for continuous high-purity H2 production in a carbon constrained world. However, it usually needs an external heat supply for the endothermic decomposition reactions. By taking advantage of the chemical looping combustion (CLC) technology, this study proposed a deep regeneration approach using H2O and O2 as regeneration agents to overcome the issues with maintaining catalytic activity and producing the heat needed for the endothermic reactions of H2 production from methane. TG-DTA and bench scale fluidized bed experimental results indicate that a deep regeneration degree of 30% or above could completely reactivate the spent AC catalyst and simultaneously generate sufficient heat than required in the methane decomposition reaction. Characterization study implies that the deep regenerated AC catalyst could maintain its physical properties within a certain number of cycles. Based on the experimental results, the chemical looping methane thermo-catalytic decomposition process was further optimized and assessed by Aspen Plus® thermodynamic simulation. The results indicate that heat and mass balances could be attained, and the circulation of the AC catalyst with a temperature difference of 262 °C between the decomposer and the regenerator enabling the process to run autothermally.

Bio: Dr. Li Yang is an assistant professor at School of Electric and Power Engineering in China University of Mining Technology (CUMT). Her research focuses on CO2 capture and hydrogen energy. Key research areas include Multiphase flow in post-combustion CO2 capture, Chemical looping combustion/gasification, and Hydrogen production technology. Yang has authored and co-authored over 20 peer-reviewed publications and 3 patents. She received a BS mechanical engineering from CUMT and a PhD in Mechanical Engineering from University of Kentucky (advisor: Prof. Kozo Saito and Kunlei Liu).

Date: Friday, Oct. 11th
Place: CB 106

Time: 3PM
Contact: Dr. Alexandre Martin 257-4462

Meet the speaker and have refreshments
Attendance open to all interested persons

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