Department of Materials Science and Engineering Seminar Series 2024

Nanostructured Catalysts for Light Alkane Dehydrogenation

Lu Shangchen

Date and time: 24 Sep 2024 (Tue.), 3:00 pm

Venue: EA-06-04

Abstract

Olefins, such as propylene or ethylene, are important chemical building blocks for producing a wide range of value-added chemicals and plastics. The abundance and low cost of alkanes have motivated extensive research into olefin production via catalytic dehydrogenation to meet the rapidly increasing global demand. However, despite their commercial success, current catalysts struggle to sustain high olefin productivity over the long term, especially in the non-oxidative dehydrogenation reaction. In this oral defense, we will introduce a novel catalyst composed of sub-nanometer alloyed PtSn clusters that can sustain propylene productivities at least an order of magnitude better than industrial catalysts and solve the productivity-stability dilemma in the propane dehydrogenation (PDH) reaction. Detailed characterization and simulations suggest that this exceptional performance is likely due to well-controlled sub-nm alloyed clusters with unique Pt active sites and their dynamic structural behaviour. In addition, we will discuss a dented Mo-V-Te-Nb oxide that achieved approximately 50% ethane conversion and over 90% ethylene selectivity at just 400°C in the oxidative ethane dehydrogenation (ODHE) reaction. These results offer promising advancements in the development of more efficient catalysts for alkane dehydrogenation and provide a foundation for further exploration of novel catalyst systems in heterogeneous catalysis.

Biography

Lu Shangchen received his B.Eng. degree from Tianjin University and the M.Sc. degree from the Department of Materials Science and Engineering (MSE) at the National University of Singapore. He is currently a Ph.D. candidate in the Department of MSE under the supervision of Asst. Prof. He Qian. His research focuses on developing novel heterogeneous catalytic nanomaterials for alkane dehydrogenation or other energy-related applications.

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