

Presents

Revealing the Dynamical Structure of Nano-Catalysts with *Operando* Transmission Electron Microscopy: State-of-the-Art and Future Opportunities

by Dr See Wee Chee

Date: 21 May 2019 (Tuesday)

Time: 3.00pm – 4.00pm

Venue: EA-06-04

Abstract

Metal nanoparticles are ubiquitously used as catalysts in a broad range of industrially relevant reactions. To enable the rational design of catalysts with better performance, it is necessary that we understand the relationship between a nanoparticle's structure and its catalytic properties. However, such insights have to be obtained from catalysts under reaction conditions because the nanoparticles can exhibit dynamical structures that do not exist outside the reactive environment. In this talk, I will describe the recent efforts at our centre in NUS where we use *operando* transmission electron microscopy (TEM) to interrogate the structure of nanoparticle catalysts under near-realistic conditions of gas pressure and elevated temperatures. TEM has always been a powerful technique for studying the detailed structure of nanoparticles. Recent developments in microfluidic reaction cells holders now allow us to study nanostructures within gas and liquid environments with TEM, and measure their reaction kinetics at the same time. First, I will discuss how Pd and Pt nanoparticles can exhibit surprisingly different structures during the catalytic oxidation of carbon monoxide and how these dynamical structures determine the low temperature activity of these nanoparticles. Second, I present results where we extend this approach towards the studies of bimetallic Pt-Ni nanoparticles and show that these nanoparticles evolves differently in reactive gas conditions depending on starting structure of the NP. Lastly, I will briefly discuss opportunities for using *operando* TEM to study electrochemical reactions in liquid environments.

Speaker

See Wee obtained his PhD from the University of Illinois at Urbana-Champaign and completed postdoctoral stints at Arizona State University and Rensselaer Polytechnic Institute. Currently, he is a senior research fellow at the Center of BioImaging Sciences in NUS. His research focuses on studying nanoscale processes that take place in gas and liquid environments using *in situ* transmission electron microscopy. In August, he will be joining the Fritz Haber Institute of the Max Planck Society in Berlin to start a program employing *in situ* electron microscopy to study electrocatalysts and electrochemical reactions at the Department of Interface Science.

ALL ARE WELCOME!

Host: A/Prof Michel Bosman