**Aluminum based metal-ceramic core-shell microstructure synthesized by hydrothermal method**

Jieun Kim

The performance of heterogeneous catalysts in practice is often governed by thermal and mass transport limitation, as the overall rate of catalytic reactions are coupled with intrinsic surface reaction kinetics, heat transport, and fluid dynamics of reactants/products through the catalysts. The thermal and mass transport properties of heterogeneous catalysts are the critical factors when the reactions are intensive with high rates and severe endothermic/exothermic reaction enthalpies. These factors are of particular importance also for the micro-structured chemical reactors and devices that demands unconventional catalytic performance under intensive reaction conditions, compact reactor integration, and rapid process dynamics: for example the micro-reactors for fuel cells in the distributed and renewable production of fuels and electrical energy. However, the conventional heterogeneous catalysts are mostly constructed on ceramic substrates (Al2O3, SiO2, etc.) with low thermal conductivities and high specific heat capacities. In this talk, I will present core-shell structures consisting of a highly heat conductive Al metal core with high surface area ceramic shell. The structures were obtained by a simple hydrothermal surface oxidation (HTSO) of Al metal particles in water or aqueous solution of hetero-metal precursors can collectively provide superior heat and mass transport properties. In addition, the synthesis route is suitable for the preparation of various shapes of substrates such as plate, fiber, mesh or powder etc. This controlled heterogeneous synthesis of metal-ceramic core-shell microstructures with various chemical and morphological features is unprecedented and shed light on their practical applicability as the heterogeneous catalyst supports for the reactions that requires intensive heat and mass flux.