SS-002 <Invited Talk>

Heterogeneous Catalysts Fabricated by Atomic Layer Deposition

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Fabrication of heterogeneous catalysts using Atomic Layer Deposition (ALD) has recently been attracting attention of surface chemists and physicists. In this talk, I will present recent results about structures and chemical activities of various catalysts prepared by ALD, particularly focusing on Ni-based catalysts.

Ni has been considered as potential catalysts for CO_2 reforming of methane (CRM); however, Ni often undergoes rapid decrease in catalytic activity with time, and therefore, application of Ni as catalysts for CRM has been regarded as difficult so far. Deactivation of Ni catalysts during CRM reaction is from either coke formation on Ni surface or sintering of Ni particles during reaction. Two different strategies have been used for enhancing stability of Ni-based catalysts; TiO_2 nanoparticles were deposited on micrometer-size Ni particles by ALD, which turned out to reduce coke formation on Ni surfaces. Ni nanoparticles deposited by ALD on mesoporous silica showed high activity and long-term stability from CRM without coke deposition and sintering during CRM reaction.

Ni-based catalysts have been also used for oxidation of toluene, which is one of the most notorious gases responsible for sick-building syndrome. It was shown that onset-temperature of Ni catalysts for toluene oxidation is as low as 120^{o}C. At 250^{o}C, total oxidation of toluene to CO_2 with a 100% conversion was found.