Abstract ID : **54**

The study of steam reforming of dimethyl ether (DME) on Pt(111)

Content

Dimethyl ether (DME) has been attracting much attention as a hydrogen source and eco-friendly fuel for diesel engines, producing no harmful materials, such as NOx and particulate matter (PM). Although it is a possible candidate for a next generation fuel, the emission of carbon species, i.e., CO, CH4, and hydrocarbons, remain as the challenges to be resolved for a zero-carbon emission policy in the future. According to the previous result [1], the hydrogen production through the DME steam reforming reaction is suppressed by the formation of by-products (CO and CH4) from unexpected side reactions and the coke formation blocking the active sites. To obtain high purity hydrogen and to design an optimal catalyst for DME steam reforming reaction, the fundamental understanding of the surface electronic/chemical states at the atomic level under practical reaction conditions is required.

In this presentation, with ambient-pressure X-ray photoelectron spectroscopy (AP-XPS), we investigated the interaction of DME with Pt(111) surface under the elevated DME pressures up to 1 mbar. Under the DME gaseous condition, the adsorbed species of DME show the sign of the DME decomposition in C 1*s* region. When the DME gas pressure reaches 1 mbar, a water gas phase peak starts to appear at ~ 535.7 eV in O 1*s* spectra, indicating possible water formation. Next, the H2O gas of 0.75 mbar is added to the DME (0.25 mbar) gas, *i.e.*, P(DME)/P(H2O)=1/3, to monitor the formation of hydrocarbons at elevated temperatures, *i.e.* typical DME steam reforming reaction occurs at 600K. As the temperature reaches 450K, the atomic carbon species start to decrease. When the temperature is increased to 500K, significant growth of hydrocarbons is observed. Our results show the basic information on how DME adsorption and decomposition occur and how coke formed on Pt(111) surface under ambient-pressure environment.

Reference
[1] K. Takeishi et al., Applied Catalysis A: General 260 (2004) 111-117.

Primary authors: JUNG, Moonjung (Gwangju Institute of Science and Technology); KIM, Dongwoo (Gwangju Institute of Science and Technology); LIM, Hojoon (National Synchrotron Light Source II, Brookhaven National Laboratory); SEO, Minsik (Gwangju Institute of Science and Technology)

Co-authors: KIM, Ki-jeong (Pohang Accelerator Laboratory); MUN, Bongjin Simon (Gwangju Institute of Science and Technology)

Presenter: JUNG, Moonjung (Gwangju Institute of Science and Technology)