

Metal Nanoparticles Embedded Metal-Organic Frameworks as Core@Shell Structure

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Metal-organic frameworks (MOFs) are solids with permanent porosity, which are built from metal clusters coordinated with organic linkers to form three-dimensional (3D) coordination networks. MOFs have attracted much attention to many material scientists involving catalyst researchers, due to fascinating features of MOFs such as facile framework tunability and diversity of framework topology [1]. Such attractive characteristics allow MOFs to be used in many applications not only in sorption and separation, but also in catalysis [2].

The catalytic function of MOFs can be originated from the metal clusters coordinated with organic linkers, in which open coordination sites around the metal centers can be used as catalytic sites while the porous structure constructed by organic linkers can control the activity and product selectivity during the reaction [3]. In particular, MOFs can also be used as catalyst support for metal nanoparticles by embedding them inside the micropore void spaces [4]. Such metal nanoparticle embedded MOFs are similar structure to core@shell that is widely known as stable catalyst structure in many reactions [5]. Despite such promising possibilities of MOFs as catalyst support or catalyst as is, less studies on the synthesis of catalytically active MOFs having open metal sites and especially core@shell structures are reported so far.

In this presentation, we addressed the synthesis study of various MOFs having various metal clusters with empty coordinated sites in a given framework structure. More specifically, various metal clusters such as Zn, Co, Cr, Fe, Ni were used for the synthesis of MOFs having framework structures involving HKUST-1 and MOF-5, which can be synthesized to possess open metal coordinated sites. For the synthesis of metal nanoparticle

embedded MOFs in core@shell structure, Pt and Ru metal nanoparticles with average size of 2 ~ 3 nm were added to the synthesis solution containing metal clusters with organic linkers. In addition, the loading of metal nanoparticles in the core@shell structure was also controlled to investigate possible maximum content inside MOFs. The resultant materials obtained from the synthesis were analyzed with X-ray diffraction, scanning electron micrograph and transmission electron micrograph [Fig. 1]. Details about the synthesis results including characterization of materials will be addressed in this presentation.

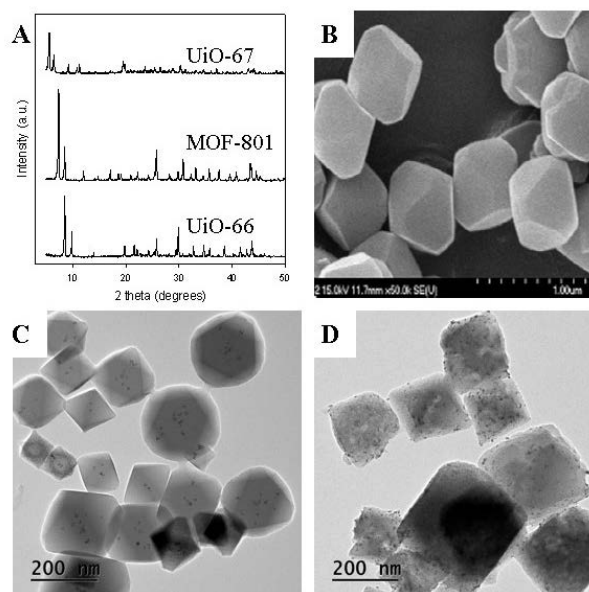


Fig. 1 (A) X-ray diffraction of synthesized MOFs. (B) SEM image of UiO-66. TEM images of (C) 0.1 wt% Pt@UiO-66 and (D) 0.5 wt% Pt@UiO-66.

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