Substrate-Selective Catalytic System Based on a Clay/Surfactant Hybrid

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Development of substrate-selective catalysts is a key topic in science. In many cases, highly developed synthetic skill and high experimental cost are required to develop conventional substrate-selective catalysts. In this study. We propose a concept for constructing substrate-selective catalysts with easy preparation method using clay/surfactant hybrids as a similar role with polypeptide in enzyme.

Anionic layered clay minerals intercalate various cationic surfactants into their interlayers. The clay/surfactant hybrids are widely utilized as adsorbents for removal of hazardous materials, and the adsorption properties are largely affected by interactions between the intercalated cationic surfactant and the adsorbed species [1,2]. In other words, the clay/surfactant hybrids exhibit substrate selectivity governed by differences in affinity between the intercalated cationic surfactant and the adsorbates.

In this study, we develop a catalytic system by incorporating catalytic molecules into a clay/surfactant hybrid, which can be prepared by simple mixing. We propose that substrate size and miscibility with the intercalated surfactants regulate access to the catalytic centers, in a manner analogous to a lock-and-key mechanism in enzymes.

The catalyst was prepared by assembling an anionic clay (saponite: SP), a cationic surfactant (cetyltrimethylammonium bromide: CTAB), and Mn (II) tetrakis(1-methyl-4-pyridyl) porphyrin (MnP) as a catalytic center. The diffraction peaks around 5 thetas of SP/CTAB and SP/MnP-CTAB hybrids shifted to lower angles compared to pristine SP, indicating that intercalations resulted in an expansion of the basal spacing between layers (Figure). The prepared hybrid powders were observed to be green, indicating the incorporation of MnP in the SP/CTAB hybrids.

Using the developed catalyst, we are investigating the catalytic epoxidation of various alkenes to explore its substrate selectivity. The detailed results will be discussed in the presentation.

Keywords:
Clay minerals, Intercalation, Substrate selectivity, Porphyrin, Epoxidation

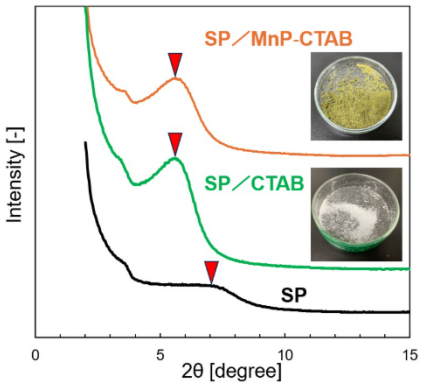

Fig. XRD patterns and observation of the hybrids

References:

[1] T. Yui et al., *Langmuir* , 2002, **18** , 4232-4239. [2] L. Marcal, et al., *ACS Appl. Mater. Interfaces* , 2015, **7** , 10853-10862.