グローバル COE 物質科学イノベーション講演会

○Lecture 1

演 題：Fine Tuned Size and Shape of Catalytic Materials: Toward Less Diffusion-Limitation in Porous Catalysts

講 師：Dr. Oki Muraza

Assistant Professor, Center of Excellence in Nanotechnology and Chemical Engineering Department, King Fahd University of Petroleum and Minerals (KFUPM), Dhahran 31261, the Kingdom of Saudi Arabia

Abstract: Innovation in nanoporous materials with the flexibility in tuning size and shape of the catalytic materials will improve catalytic performance of the corresponding materials. The presentation will highlight two approaches to reduce mass-transport limitation: (i) smaller crystals of zeolites to shorten diffusion path lengths and (ii) coated/grown carbon nanofibers on structured foam monolith.

The first part of this part of this presentation will highlight our current activities on size modification of crystalline zeolites. The presences of micropores offer both advantage of shape selectivity property and disadvantage of small pore diameters which suffer from diffusion limitation and reduce the catalytic activity of the zeolites. The thinner the zeolite dimension the easier for reactant molecules to diffuse into the zeolite structure and consequently product molecules can also diffuse out quickly. The smaller crystal will improve catalyst effectiveness and facilitate faster diffusion and it will reduce pore blocking by coke deposition. Both conventional hydrothermal synthesis and microwave-assisted hydrothermal synthesis has been explored to fabricate smaller zeolite crystals.

The second approach to improve catalyst accessibility is the catalytic coatings by using growing carbon nanofibers on 3D solid substrates such as solid foam monolith. The application of structured catalysts and reactors in intensified chemical processes requires new techniques to incorporate catalytically active layers onto their structured supports. These catalytic active layers prevent high pressure drop, enhance catalyst accessibility and eliminate mass transfer limitations. In order to improve material loading into thin support layers as structured catalysts, high surface area materials are required to allow high loading and incorporation of highly active nanoparticles. Nanostructured carbon materials such as carbon nanofibers are promising graphitic catalysts and catalysts supports for wide applications in energy-related catalysis.

○Lecture 2

演 題：Novel Hierarchical Zeolite and Ordered Mesoporous Silica for Upgrading the Structurally-Complexed Polynuclear Aromatics

講 師：Dr. Nabil Al-Yassir

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Abstract: LCO, which accounts for approximately 10-20% of FCC products, is a highly interesting blending stock to diesel pool because of the boiling point range similarity. The major disadvantages of LCO, on the other hand, are primarily related to the high content and the structural complexity of mainly bulky multiring polynuclear aromatics. The current upgrading options (i.e. direct blending, catalytic saturation, and hydrocracking) are not capable of meeting the current fuel specifications, let alone those of the future. Recently, selective ring opening (SRO) approach has been proposed as an alternative. Yet, none of the studied SRO based catalysts (i.e. zeolites, ordered mesoporous silica, mixed oxides) achieved the great potentials of SRO process. This is mainly due to structural instability, diffusion limitations, strong acidity and fast deactivation. In this presentation, we will present our novel synthetic approach to tackle these issues. We have synthesized two different materials; namely highly stable periodic mesoporous silica (MCM-41), and hierarchical zeolites (Beta/MCM-48) using the double surfactant (pore directing agent) method.

日 時：2011年8月19日（金）13:00～14:30

場 所：工学部材料・化学棟講義室（MC117）

共 催：公益社団法人 石油学会 海外協力分科会

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連絡先：工学研究院有機プロセス工学部門 増田隆夫（内線：6550）