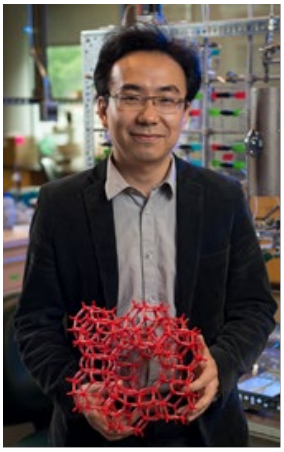
第423回触媒科学研究所コロキウム

Development of P containing zeolite catalysts for production of aromatics from biomass



Dr. Wei Fan

(Associate Professor, University of Massachusetts Amherst)

2019年5月23日（木）15：00—16：30

創成科学研究棟4階セミナー室BC）

http://www.cat.hokudai.ac.jp/access.html

The need for sustainable production of everyday materials in addition to market volatility of petroleum-based feedstocks has motivated research into the production of renewable aromatic chemicals from biomass. Specific chemicals of interest include p-xylene, the feedstock for polyethylene terephthalate (PET). We have proposed a renewable method of producing renewable p-xylene by cycloaddition of biomass-derived dimethylfuran (DMF) and ethylene, which serves as the last step in a complete process for producing p-xylene from cellulose.The reaction occurs by symmetry-allowed [4 + 2] Diels-Alder cycloaddition of ethylene and DMF and subsequent aromatization by acid-catalyzed dehydration to p-xylene. Our studies suggested that H-BEA with Brønsted acidity and Zr-BEA with Lewis acidity exhibit a high p-xylene yield of 75% from the reaction pathway. However, the zeolite catalysts also catalyzed the formation of alkylated and oligomerized byproducts. In this talk, I will discuss catalytic reaction kinetics and mechanism for p-xylene formation from DMF and ethylene over different catalytic active sites. Inspired by these fundamental studies, we recently developed a new type of zeolite catalyst, that is, phosphorous-containing siliceous zeolites. The catalysts can selectively catalyze the dehydration reaction from the furan-ethylene cycloadduct to p-xylene, without catalyzing reactions producing alkylated and oligomerized products. In particular, the phosphorous-containing zeolite Beta (P-BEA) and hierarchical self-pillared pentasil, P-SPP, are active, stable and selective catalysts for this reaction with an unprecedented p-xylene yield of 97%. This catalytic behavior is distinct from that of Al-containing zeolites and establishes a commercially attractive process for renewable p-xylene production.

Wei Fan is an associate professor at Chemical Engineering Department of University of Massachusetts Amherst. Dr. Fan's research group focuses on the rational synthesis of nanoporous materials by engineering their pore structure and size, surface properties and active sites based on the comprehensive understanding of their crystallization mechanism. Dr. Fan received his PhD from the University of Tokyo, Japan, under supervision of Prof. Okubo Tatsuya, and worked with Prof. Michael Tsapatsis in the University of Minnesota from 2007 to 2010 as a post-doc researcher. He started his research group at University of Massachusetts Amherst on 2010. He has published more than 90 peer-reviewed papers on international journals including Nature Materials, Journal of the American Chemical Society, Angewandte Chemie International Edition etc. He has received 2016 Barbara H. and Joseph I. Goldstein Outstanding Junior Faculty Award from UMass Amherst and 2016 Outstanding College of Engineering Teaching Award from UMass Amherst. He is one of the 3M Non-Tenured Faculty Awardees in 2014.

問合せ先：触媒科学研究所・福岡　淳（fukuoka@cat.hokudai.ac.jp・011-706-9140）

423rd Institute for Catalysis (ICAT) Colloquium