PURDUE INNOVATES | Office of Technology Commercialization

Methods for Preparing MFI/TON-type Zeolite Intergrowths

Dual-framework zeolites that combine MFI's 3D pores with TON's 1D channels for higher selectivity, diffusion, and catalyst life in refining and petrochemicals.

Zeolites are crystalline microporous aluminosilicates used as acid catalysts in petrochemical and refining industries due to their ability to modulate reaction pathways through shape selectivity and framework topology.

Purdue researchers have developed a novel method for the synthesis of MFI/TON-type zeolite intergrowth structures using a dual structure-directing approach (SDA). The SDAs utilized can range from various bases such as ethylenediamine that are mixed with one silicon precursor and one aluminum precursor to provide a precursor gel. The researchers can tailor the pore connectivity that results in a robust catalyst that offers enhanced selectivity and improved diffusion properties. By integrating the three-dimensional pore network of MFI with the one-dimensional channels of TON, the resulting intergrowth structure exhibits the advantages of both frameworks. The developed zeolites show promise as useful catalysts within the oil/gas, energy, and separations industries for improving reaction rates, selectivity and adsorption/diffusion properties of traditional pure-phase MFI or TON zeolites.

Technology Validation:

-Powder X-ray diffraction (pXRD) of zeolite samples was performed to calculate the Si/Al ratios

-Scanning electron microscopy (SEM) images revealed the morphology of the zeolite, found to be agglomerated needle-like in shape

-Transmission electron microscopy (TEM) of zeolite samples confirmed the crystals exhibited a long, high aspect-ratio morphology

-Electron diffraction spectroscopy (EDS) in conjunction with SEM provided evidence for the presence of intergrowth in the zeolites

Advantages:

Technology ID
2025-GOUN-70985

Category
Chemicals & Advanced Materials/Specialty & Performance Chemicals
Semiconductors/Devices & Components
Materials Science & Nanotechnology/Materials Testing & Characterization Tools

Further information
Will Buchanan
wdbuchanan@prf.org

View online

-Enhanced selectivity

-Improved diffusion properties

-More robust catalyst with a longer lifetime

-Crystallite size of 0.01 microns to 5 microns

Applications:

-Hydrocarbon cracking

-Olefin oligomerization

-Gas separation and adsorption

TRL: 4

Intellectual Property:

Provisional-Gov. Funding, 2025-04-11, United States

Keywords: Chemical Engineering, Chemistry and Chemical Analysis, Zeolites, Catalysis, Oligomerization, Olefins