Self-Pillared, Single-Unit-Cell Sn-MFI Zeolite Nanosheets and their Use for Glucose and Lactose Isomerization

Scientific Achievement

- A hierarchical zeolite catalyst, containing micro and mesopores and Lewis acid catalytic sites, was synthesized by single-step hydrothermal crystallization.
- High yields for sugar isomerization and p-xylene production from dimethyl furan were demonstrated.

Significance and Impact

- The hierarchical zeolite catalyst contains Sn exclusively located at the framework (substituting framework Si); the desirable arrangement for selective Lewis acid catalysis.
- The zeolite domains are single-unit-cell (2nm) thick and they are surrounded by a network of 2-8nm mesopores, combining the catalytic activity of zeolites with accessibility of mesoporous materials.

Research Details

Absence of extra-framework Sn confirmed by electron microscopy, nuclear magnetic resonance and infrared spectroscopy - a collaborative effort between UMN and Caltech groups. Catalyst also recently tested for p-xylene production by UMass group