הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע"ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Seminar

Monday, February 9th, 2026 at 13:30

Room 6

Conversion of Methanol to Olefins (MTO) on Modified ZSM-5 Catalysts

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MSc Seminar

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The Methanol-to-Olefins (MTO) process is a key catalytic route for producing light olefins, with ZSM-5 zeolite being widely employed due to its high activity, thermal stability, and shape selectivity. However, the strong acidity of ZSM-5 often promotes coke formation, leading to catalyst deactivation and highlighting the need for acidity control and improved catalyst stability.

In this study, ZSM-5 catalysts were modified with the alkaline-earth metals magnesium and calcium, individually and in combination, to investigate the most effective modification strategy and operating conditions for alkaline-earth metal incorporation into ZSM-5 catalysts. The modified catalysts were extensively characterized using ICP-OES, SEM–EDS, XRD, TGA–DTA, and XPS to evaluate metal incorporation, structural integrity, surface composition, implications on catalyst acidity and the suitability of different characterization techniques for detecting low-level dopant loadings. Catalytic performance was assessed under a range of operating conditions, focusing on methanol conversion, product selectivity, and catalyst stability, with product analysis performed by GC-MS.

The results indicate that optimal olefin selectivity was achieved using Mg,Ca-ZSM-5 as the catalyst at 450 °C, 3 bars, and a WHSV of 35 h^{-1}. Under these conditions, optimal reaction time of 1 hour was identified, yielding an olefin selectivity of 50% of the total products. Complete methanol conversion was maintained throughout the first hour of reaction, followed by a marginal decrease to 99.8% after 1.5 hours. In addition, an effective catalyst regeneration procedure was developed, consisting of a 1-hour treatment at 530 °C.

Refreshments will be served at 13:15.