

Spatial Distribution, Strength and Dealumination Behavior of Acid Sites in Nanocrystalline MFI Zeolites and Their Catalytic Consequences

최민기*, 김경수¹, 유 룡¹
한국과학기술원 생명화학공학과; ¹한국과학기술원 화학과
(mkchoi@kaist.ac.kr*)

The spatial distribution, acid strength, and steam stability of internal and external acid sites were systematically investigated for nanocrystalline MFI zeolite with different crystallite size (2–300 nm), which were synthesized using gemini-surfactants having different alkyl chain lengths. FT-IR spectroscopy using pyridine and 2,6-di-tert-butylpyridine as a base probe revealed that the concentration of external acid sites increased with a decreasing crystallite size. The external sites were weaker than the internal sites in acid strength, but could still catalyze n-octane cracking reactions that require the strongest acid strength among various acid-catalyzed reactions. Most notably, the external acid sites of zeolites exhibited remarkably higher steam stability at 873 K than the internal acid sites. Such an observation was supported by the catalytic results in methanol-to-gasoline reaction and the Claisen-Schmidt condensation involving bulky molecules. It is expected that the nanocrystalline zeolites having abundant external acid sites would provide the significant benefits of high hydrothermal stability of acid sites and hence catalytic reusability, in addition to the well-known advantages of enhanced mass transfer and high catalytic activities for large molecules.