

A mechanical study on the dehydration of lactic acid over zeolites for renewable acrylic acid

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In the dehydration of biomass-derived lactic acid to renewable acrylic acid (AA), alkali-exchanged zeolite catalysts showed remarkable activity and selectivity. Especially, zeolites with MFI structures (e.g., ZSM-5) showed high potential in being developed as a commercial catalyst due to its excellent dehydration performance and high selectivity. The overall carbon mole yield of acrylic acid was reported to be as high as ~80%. The remaining selectivity is mainly due to acetaldehyde produced by the undesired decarbonylation reaction. The formation of acetaldehyde was found to be favored over strong acid sites such as Brønsted acidity. Thus, there is still room for improving the AA selectivity once we properly adjust the acidity of the zeolite catalysts in lactic acid dehydration. However, no obvious relationship between acid-base sites and dehydration mechanism has been reported to date. In this work, we tried to understand the acidity-activity relationship in the lactic acid dehydration through in-situ FT-IR spectroscopy combined with kinetic measurements using various zeolites with tuned acidity.