Effect of Mesoporosity in MFI Zeolites on Catalyst Longevity: A Case Study in Conversion of Methanol into Hydrocarbons

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In recent years, zeolite materials with hierarchically meso-/microporous structures have found several beneficial effects on catalytic performances, compared to conventioanl zeolites. Particularly, these hierarchical zeolites exhibited a remarkably long catalyst lifetime in a variety of acid-catalyzed reactions. Such a slow deactivation behavior was attributed to a facile molecular diffusion through mesopores. However, it was still unknown why the mesopore generation could lead to a catalytic longevity. In the present work, we investigated coke formations during methanol-to-hydrocarbon conversion over MFI zeolites, to understand why the lifetime could be improved by the generation of mesopores. When a location of cokes was probed from argon adsorption, in the case of MFI zeolites having mesoporosity, the cokes were predominantly formed on a surface of mesopore walls. However, in the case of soley microporous MFI zeolites, the cokes were mostly deposited inside micropores. We believe that a short diffusion path length and hence facile diffusion of coke precursors were most likely the cause for the improved catalyst lifetime.