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論文要約

Development of Novel Reaction Spaces in Porous Materials for Catalytic Reactions Involving Bulky Molecules

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This thesis focuses the creation of novel reaction spaces in porous materials for catalytic reactions involving bulky molecules, emphasizing the crucial role of developed synthesis method. The thesis is divided into six chapters.

Chapter 1 introduces the basic background of porous materials, especially mesoporous carbons and microporous zeolites, and their synthesis methods and the application for catalytic reactions involving bulky molecules. It sets the research objectives and significance of this thesis.

Chapter 2 discusses a hard-template method for synthesizing the ordered mesoporous carbon replicas (CRs) with the novel 3D structure, where the silica nanospheres (SNSs) was used as the template. The physical and chemical properties of both CRs and SNS are analyzed here to demonstrate the influence of stacking behaviors of SNSs on the corresponding CRs.

Chapter 3 extends the research of Chapter 2 using the CRs as support to prepare the Pt/CR catalysts. The characterization results of all obtained catalysts are demonstrated and the catalytic performance for C-methylation of 2-phenylethanol are discussed. It is indicated that the mesoporous 3D carbons exhibited better property as support, contributing to the smaller particle size of Pt and thus improving the conversion of 2-phenylethanol.

Chapter 4 concludes the direct-synthesis and post-synthesis method of SFH-type zeolite, aluminoborosilicate SSZ-53. The results show a difficulty of doping more Al into the SFH-type framework to reach a Si/Al ratio of sample less than 80. The characterization of all obtained samples and their catalytic performance of acylation of 2-naphthalene are also explained.

Chapter 5 develops the interzeolite conversion (IZC) of aluminoborosilicate SSZ-53 using MFI-type zeolite as the staring material, which shortens the synthesis time from 5 to 2 days. The unique 2-step transformation pathway is proposed to figure out the mechanism during the hydrothermal synthesis. The obtained samples show promising physical and chemical properties, as well as the catalytic activity in acylation of 2-naphthalene.

Chapter 6 summarizes the findings across all chapters, emphasizing its importance of developing synthesis methods of porous materials to make contribution to the catalytic reactions involving bulky molecules.