

Thammachat Metchanan 2011: Ni/ZSM-5–SBA-15 Composites Catalyst for Carbon Dioxide Hydrogenation with Methane. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Metta Chareonpanich, D.Eng. 92 pages.

ZSM-5 zeolite and SBA-15 mesoporous silica exhibits the great performance when used as catalyst supports for various kind of applications because of their unique structures. However, their drawbacks were also reported when used as supports for Ni/ZSM-5 and Ni/SBA-15 catalysts in CO₂ reforming of CH₄ reaction. The microporous structure of ZSM-5 zeolite generally leads the catalysts to deactivate by carbonaceous species and aggregated Ni metals on the surface of the catalyst, while SBA-15 mesoporous silica requires very high operating temperature to obtain its best performance. Therefore, ZSM-5–SBA-15 composites support comprised of good advantages of ZSM-5 zeolite and SBA-15 mesoporous silica was synthesized and investigated for various factors that affected to its structure and morphology. Then, it was used as the support for Ni loading in CO₂ reforming of CH₄ reaction. It was found that in order to obtain the complete structure of ZSM-5 zeolite in ZSM-5–SBA-15 composites, at least 7 h of the hydrothermal treatment time period was required. The template and high acid condition of SBA-15 mesoporous silica synthesis did not affect on the structure of ZSM-5 zeolite. The smaller size of ZSM-5 zeolite seeding, more uniform structure of ZSM-5–SBA-15 composites was obtained. Moreover, Ni/ZSM-5–SBA-15 catalyst exhibited the highest performance in CO₂ hydrogenation with CH₄ compared to those of Ni/ZSM-5 and Ni/SBA-15 catalysts due to the advantages of ZSM-5 zeolite and SBA-15 mesoporous silica in its structure.

Student's signature

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