Effects of Hierarchically ordered macro-mesopororous structure and potassium addition on 1-Methyl naphthalene steam reforming at the low temperature over xK/Ni-Al_2O_3 catalysts

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Effects of macroporous Al_2O_3 and K on steam reforming at the low temperature were investigated in this study. The introduction of K onto Ni-Al catalysts created more nickel active sites, promoting the steam reforming over Ni sites. The hierarchically ordered macro-mesoporous structure in support played an important role in improving the diffusion of large molecules to the active sites, which promoted both the catalytic cracking and steam reforming, resulting in high gas yields and conversion. In addition, macro-mesoporous structure decreased the coke amount condensed on surface of catalysts, leading to the slow deactivation of the catalysts. Based on products distributions produced from the reaction tests conducted from 500-600oC in a fixed-bed reactor, there were four main reactions: steam reforming, water gas shift, hydrogenation and catalytic cracking. The catalytic cracking contributed to breaking up the aromatic rings in 1-methyl naphthalene and carbon monoxide was converted to carbon dioxide during water gas shift reaction.