Synthesis of Jet-fuel through Oligomerization of Butene Mixture over Ni-doped Aluminosilicate Catalysts

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To resolve the environmental issues such as global warming, the investigation of producing fuels, mostly jet fuels, from the biomass has been actively progressed.[1] Especially, many researchers are studying alcohol to jet (ATJ) process that produces jet-fuel by oligomerization of butane mixture after butanol dehydration from biomass [2,3].

In this study, we investigated the most effective catalyst to synthesize the jet fuels composed with mostly C_8~C_{16} hydrocarbon through the oligomerization based of butene mixture produced from butanol dehydration in ATJ process. Based from the result of previous studies, the catalysts used in this study are based on HZSM-5. In addition, a mesoporous aluminosilicate prepared from ZSM-5 (MMZ_{ZSM-5}) was adapted as a support. We used the Ni/ZSM-5 catalysts prepared by incipient wetness and Ni/MMZ_{ZMS-5} catalysts synthesized by atomic layer deposition (ALD). N_2 Adsorption, XRD, XRF, Pyridine-IR and NH3-TPD are used to analyze the structural properties of catalysts. A butene mixture composed of 43.5 % of 1-butene and 56.5 % 2-butene was used as a model reactant for the oligomerization reaction. The oligomerization of mixed butene was carried out in a fixed bed continuous-flow reactor. The reaction temperature and pressure of the reaction were 350 ^oC and 15 bar, respectively.

As a result, Ni-doped catalysts generally have higher C_8~C_{16} hydrocarbon yield compared to ZSM-5 and MMZ_{ZSM-5}. Among various catalysts, Ni-doped MMZ_{ZSM-5} prepared by by ALD has the highest C_8~C_{16} hydrocarbon yield.

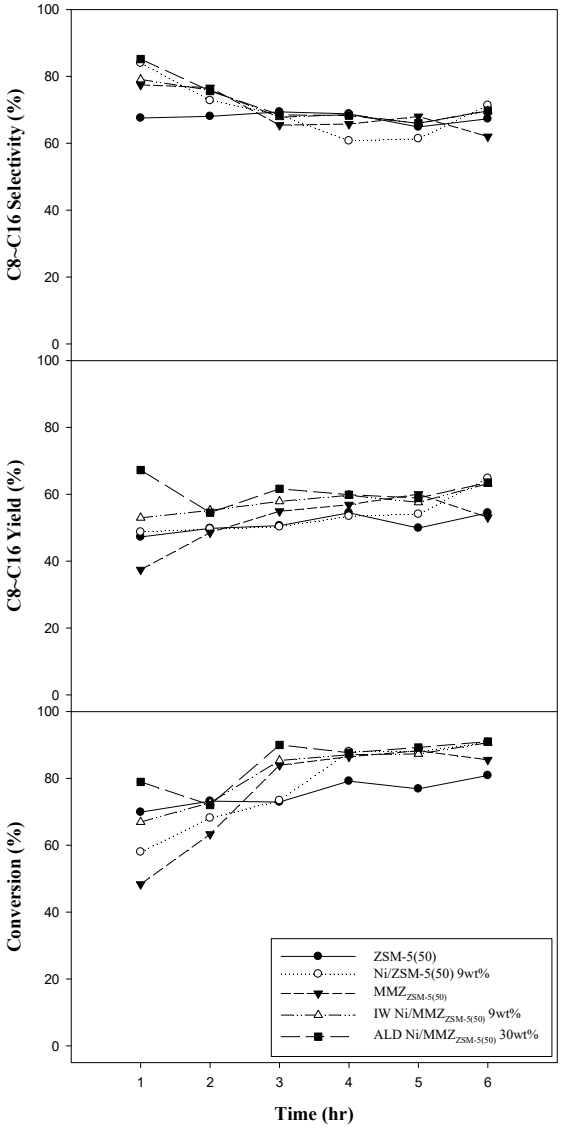

Fig.1 Conversion, selectivity, and yield over various catalysts based on ZSM-5.

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