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Synthesis of Liquefied Petroleum Gas *via* Methanol and/or Dimethyl Ether from Natural Gas (Part 1) Catalysts and Reaction Behaviors Associated with Methanol and/or Dimethyl Ether Conversion

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Synthesis of liquefied petroleum gas (LPG) from methanol and/or dimethyl ether (DME) was investigated over various zeolite catalysts. H-ZSM-5 with the MFI structure was confirmed to be the optimum catalyst for selective LPG synthesis. Effects of the silica-alumina ratio in H-ZSM-5 on the methanol or DME conversion were also investigated. The conversion of methanol or DME was maximum at a silica-alumina ratio of 50 or 90, respectively. Selectivities towards LPG hydrocarbons improved with increasing silica-alumina ratio for both feeds. The correlation between catalytic performance of the selected H-ZSM-5 catalyst and kinetic factors in methanol conversion was also examined. The operating conditions for the formation of C_3-C_4 hydrocarbons were identified by optimizing gas hourly space velocity and reaction temperature as well as feed partial pressure, *e.g.*, 20,000-30,000 h^{-1}, > 400°C, and > 45 kPa, with a system pressure of about 120 kPa. LPG fractional hydrocarbons could be formed selectively from methanol, DME, or a mixed feed. Addition of steam to the nitrogen used as diluent gas led to a decrease in DME conversion.

Keywords: Natural gas, Liquefied petroleum gas, Methanol conversion, Dimethyl ether conversion, Zeolite catalyst, Synthetic fuel

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