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Synthesis of Liquefied Petroleum Gas *via* Methanol and/or Dimethyl Ether from Natural Gas (Part 2) Improvements in Catalysts for Methanol and Dimethyl Ether Conversion

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For the proposed synthesis of liquefied petroleum gas (LPG), MFI zeolite catalysts were prepared for selective conversion of methanol or dimethyl ether (DME) through either surface modification of parent ZSM-5 or isomorphous substitution of MFI metal heteroatoms. Fe^{3+}-exchanged ZSM-5 was most effective to improve C_3-C_4 fractional selectivity among the surface modified H-ZSM-5 catalysts. The presence of iron, gallium and/or aluminum among the framework heteroatoms of MFI metallosilicates was correlated with improved methanol conversion to LPG hydrocarbons. Zeolites containing gallium or gallium_aluminum catalyzed methanol conversion together with aromatization. The incorporation of iron into MFI framework greatly reduced aromatization and carbon-chain growth. Zeolite containing iron and aluminum was quite effective for improving the LPG fractional selectivity. Effects of the modification procedure with iron species on catalytic performance were verified. The co-existence of iron with aluminum as heteroatoms in the MFI framework provided the best selectivity compared to ion-exchange with Fe^{3+} and loading of iron or oxides. DME conversion over H-FeAlMFI-silicate and unmodified H-ZSM-5 confirmed the improvement in catalytic selectivity and stability.

Keywords: Natural gas, Liquefied petroleum gas, Methanol conversion, Dimethyl ether conversion, MFI metallosilicate, Catalyst modification

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