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Development of novel catalysts for fischer-tropsch synthesis

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Binuclear metal complexes of copperand cobaltwere supported as sub monolayer, monolayer and multilayer films on silica (Cab-O-Sil). The supported metal complexes were characterized by elemental analyses, DRIFTS, XRD and TGA. Elemental analysis results confirmed that the carbon/metal ratio of the supported complexes was the same as the parent metal complexes. Upon adsorption, certain IR peaks of the parent metal complexes were shifted indicating the strong interaction between the metal complex and the silica support. Metal complex loadings were monitored by UV-vis spectroscopy and confirmed by TGA and elemental analysis. After calcination, monolayer and multilayer films were used as catalysts for the Fischer-Tropsch (FT) reaction (conversion of CO and H_2 to gasoline) at moderate temperatures and high pressures. Total CO conversions and gasoline yields were studied as a function of time of syngas on stream (15-75 h), temperature (310, 320 and 350˚C), and total pressure (750 and 910 psi). The product distribution of multilayer catalyst differed with extended reaction time on stream, temperature and pressure. C_{4+} hydrocarbon selectivity significantly increased with a 70 h reaction time. This suggests that extended reaction times give enough time for short chain hydrocarbons to grow into long chain hydrocarbons. After a 70 h reaction time, CO_2 selectivity decreased dramatically. An increase in temperature also increased the C_{4+} hydrocarbon selectivity. 910 psi pressure reaction conditions also shifted the FT reaction to the product side. The C_{4+} product selectivity was improved by the 910 psi pressure reaction conditions.

Key words: DRIFTS, Fischer-Tropsch synthesis, monolayer, Silica-supported catalysts