Activity and durability of Cu-spinel catalysts for steam reforming of dimethyl ether

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Steam reforming of dimethyl ether (DME SR : $(CH_3)_2O$ + 3 H_2O → 6 H_2 + 2 CO_2) has been investigated for catalytic hydrogen production using composite catalysts. Among the spinel catalysts copper ferrite spinel ($CuFe_2O_4$) mixed with γ-alumina was active for hydrogen production. A highly active composite was achieved only when the Cu spinel was calcined at *ca.* 900 ºC after the complete formation of spinel in oxidized state. On the other hand, γ-alumina should be heated at or below 700 °C. The calcination temperature strongly affected the crystallinity and reducibility of the copper ferrite spinel and the acidity of alumina. During reforming reaction fine particles of metallic copper were deposited on the reduced host oxide. Strong chemical interaction between Cu and reduced oxide was suggested from high resolution TEM observation. A porous microstructure of the oxide and fine metallic copper particles were developed with the reduction of dense spinel oxide. The DME conversion and hydrogen production significantly depended on reforming temperatures (T_r). The composite catalyst with $CuFe_2O_4$ and alumina exhibited excellent activity for DME SR as compared with commercial $Cu/ZnO/Al_2O_3$.