IN-SITU CHARACTERIZATION OF SPINEL-SUPPORTED NANOPARTICULATE METAL CATALYSTS

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Development of a dispersed metal nanoparticulate catalyst supported by a defect spinel offers the ability to re-generate the catalyst to eliminate coking. The degraded metal catalysts can be resorbed into the oxide host through oxidation and subsequently reduced again to form small, dispersed particles on the defect spinel. Several aluminate and ferrite spinels featuring Co, Ni, and Cu in varying molar ratios synthesized with or without structural stabilizing cations will be discussed. In-situ x-ray characterization of the powders during reduction under H_2 and during oxidation/reduction cycles will be presented, highlighting the mechanisms of phase development, crystallographic phase evolution, and particle coarsening. Similar studies will be done on samples that have been exposed to methane and hydrogen, with and without H2S, under typical use conditions to simulate the effects of the fuels on the catalyst.