

226g Highly Dispersed Stable Metallic Co and Ni Catalysts Prepared by Reduction of Co and Ni Substituted Mesoporous Molecular Sieves

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Highly dispersed Co and Ni catalysts in the metallic state were prepared by a reduction treatment of Co- and Ni-MCM-41, and the surface status was investigated by multiple characterization techniques. (TPR, FTIR, Chemisorption, TEM, and X-ray absorption) The particle size of the metallic clusters was sub-nanometer with 100% dispersion on the MCM-41 surface. These highly dispersed small metallic clusters maintained dispersion stability at high temperature, higher than the reduction temperature of surface metal oxides, by anchoring to the unreduced and partially reduced metal ions on the surface. Slow reduction caused partial occlusion of the metal surface within silica, resulting in weak adsorption of reactant and slowing the migration of the metallic clusters. By the co-incorporation of irreducible ions, i.e. Ti and Zr, in the Co- and Ni-MCM-41 systems, the reduction and migration stabilities of metallic Co and Ni clusters were significantly improved ; metallic Co and Ni clusters maintained high dispersion and cluster size at the reduction temperature of framework Ni and Co, 650oC~700oC. Further modification of these stable metallic clusters may provide new catalytic systems for specific applications requiring metallic clusters as catalytic active sites, i.e. controlling the chirality of SWNT, selectivity of desired products in methanation and Fischer-Tropsch reaction, etc.