Synopsis of Original Research Paper

Preparation of clay materials with reconstructive function and their adsorption properties

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Clay materials form an important group of inorganic layered compound and are useful materials with a great variety of applications as adsorbents, decolorizing agents, and ion exchangers. In this work, composites of smectite with layered double hydroxide (LDH) were synthesized by various methods and their porous properties and microstructures examined. Commercial saponite and co-precipitated LDH [$Mg_6A_{l2}(CO_3)(OH)_{16}$-$4H_2O$] powders were used. Composites prepared by dry mechanical mixing, wet mechanical mixing and soft-chemical processing were characterized by XRD, FT-IR, XPS, SEM, TEM, and N_2 and H_2O adsorption and desorption. The specific surface area of saponite / LDH composites were intermediate between those of LDH and saponite. The value for the dry milled sample (167 m^2/g) was smaller than for the other samples (about 250 m^2/g). The pore size distributions of the saponite / LDH composites differ from those of saponite and LDH, the peaks ranging from 1nm to 30 nm according to the synthetic method. The resulting porous properties depend on the laminate structure. The specific surface area estimated from H_2O adsorption of the saponite / LDH composites were ranged from 326 to 390 m^2/g. These values were very higher than that estimated by N_2 adsorption because of peculiar adsorption of H_2O. A hydrophilicity of these composites was evaluated using a coefficient of specific surface area by H_2O and N_2, described as S_{H_2O} / S_{N_2}. The estimated coefficient of the saponite / LDH composites were ranged from 1.2 to 2.1. The value for the dry milled sample (2.1) was extremely higher than for the other samples (1.2 ~ 1.5). Consequently, dry milling was the most effective method for modifying the porous properties of the composites. Furthermore, the reconstructing function of the laminate structure was controllable by heat treatment in the dry-milled composite.