
Rheological Properties of Organophilic Synthetic Hectorites and Saponites

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Abstract: To determine the dependency of rheological properties on mineralogical characteristics, eleven organophilic hectorite and nine organophilic saponite samples were prepared from hydrothermally synthesized smectites and a quaternary ammonium salt containing mainly octadecyl groups as alkyl chains and were examined by X-ray powder diffraction (XRD), particle size, chemical, and rheological procedures. The rheological properties of the organophilic products dispersed in toluene were found to depend chiefly on (1) particle size, (2) the expansion behavior of the stacked clay platelets, in which the amount and location of negative charge of the silicate layer affected the expandability, and (3) the amount of methanol added as a polar activator. By the addition of 2–4% methanol, apparent viscosities of the hectorite clays were drastically increased at low shear rate, although even a 10% addition did not significantly affect the saponite clays. Under the most suitable gelation conditions, the saponite clays showed lower apparent viscosity than the hectorite clays. Inasmuch as the former had its negative charge near the surface of the silicate layer and formed strong bonds to the organic ion, the expansion of the platelets was apparently difficult. An optimum layer charge for increasing the viscosity was found; specifically 0.45–0.50 and 0.50–0.55 equivalents per half unit cell for saponite and hectorite clays, respectively. Because the saponite clays contained a denser population of organic ions than the hectorite clays, the ion density in the interlayer of both clays was considered to be the same, i.e., about 0.4 organic ions per unit *ab* area.

Key Words: Hectorite • Organophilic • Particle aggregation • Rheology • Saponite • Smectite • Viscosity • X-ray powder diffraction

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