
Physico-Chemical Properties of Illite Suspensions after Cycles of Freezing and Thawing

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Abstract: The effect of freezing and thawing on the rheological behavior of illite suspensions was studied by examining viscosity and plasticity. Stability of suspensions was characterized by a hysteresis loop of thixotropy. Thermal gravimetric and differential scanning calorimetry analysis were also used. After initial freezing and thawing, the flow curves of the suspensions show an increased viscosity, an “irregular up line”, and a greater hysteresis loop of thixotropy. The ratios of mean viscosity of previously frozen (F) and control (O) samples (η_F/η_O) for non-expandable 2:1 phyllosilicates ranges from 1.3 to 2.1. Addition of monovalent (0.1% Na₂SiO₃) and divalent cations (0.3% CaCl₂ or BaCl₂) increase and decrease the shear-stress difference between F and O samples, respectively. Prior freezing of clay samples results in an increase of plasticity by ~20–30%. The thermal analysis data of F samples show an increase in weight loss, and a decrease in enthalpy of dehydration. The changes of physico-chemical properties from cycles of freezing and thawing are long lasting. The freezing memory effect of illite-type clays is expected to play an important role in ceramic processing, *i.e.*, casting processes, plastic formation, and sintering.

Key Words: Illite-Type Clays • Plasticity • Pretreatment With Cold • Thermal Analysis • Thixotropy • Viscosity

Clays and Clay Minerals; December 1999 v. 47; no. 6; p. 718-725; DOI: [10.1346/CCMN.1999.0470605](https://doi.org/10.1346/CCMN.1999.0470605)

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