

Changes of viscosity and yield stress of montmorillonite-water system with reference to consistency limits

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Montmorillonite abundantly exists in the slip zones such as earthquake faults and landslides. Water contents are an important factor for controlling slip behavior, since montmorillonite contains a considerable amount of water molecules compared with other clay minerals. Clay-water system is known to act as a Bingham fluid and we estimated yield stress and Bingham viscosity at different water contents from 100 to 1000 % using a rheometer (Brookfield Rheometer). Starting material is montmorillonite (JCSS-3101; Na-montmorillonite from Tsukinuno, Yamagata Prefecture, NE Japan) provided by Japan Clay Science Society. Yield stress drastically decreases from ca. 20000 Pa (100% water content) to ca. 3000 Pa (600%), and it does not remarkable change at higher water content conditions. Bingham viscosity also large decrease from 1.6 Pa · s (100 % water content) to 0.4 Pa · s (600 %) and then it does not show remarkable change at higher water contents. Thus, there is an inflection point at 600%. The consistency limits of montmorillonite are accepted as ~ 10 %, 54 ~ 98 %, and 290 ~ 710 % for the shrinkage, plastic, and liquid limits, respectively. The inflection point is well correlated to liquid limit of montmorillonite.

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