Energy Dissipation of a Kaolinite at Different Water Contents

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Abstract: A Georgia kaolinite, at water contents from 55 to 95 per cent, was tested by means of a Weissenberg Rheogoniometer under conditions of pure shear with sinusoidally varying deformation over a frequency range of 3 decades. The results, including time-dependent effects, are expressed in terms of the magnitude of the complex modulus and the phase angle, as developed in the theory of linear viscoelasticity, and stress-strain hysteresis curves. The complex modulus is a two-component quantity, which has a real part associated with the elastic or energy storage characteristics of the material and an imaginary part associated with its viscous or energy dissipation characteristics. Although the complex modulus interpretation is very good for linearly viscoelastic materials, its applicability and usefulness diminishes as the material departs from linear viscoelastic behavior. On the other hand, the determination of energy dissipation from stress-strain hysteresis curves does not depend on any assumption concerning material behavior, because the area enclosed by the curve gives a direct measure of the energy dissipated in a single cycle of deformation. The dissipation characteristics obtained by the two methods are compared and used to illustrate the degree of validity and some limitations of linear viscoelasticity theory.

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