

THE RHEOLOGY OF NON-AQUEOUS SUSPENSIONS OF MODIFIED ECCABOND FINE (EBF) CLAY

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ABSTRACT:

This paper discusses the rheological properties of different contents of a commercially available Southern African clay, Eccabond fine (EBF), modified with hexadecyl trimethyl ammonium bromide, and Cloisite 15A (C15A), modified with dimethyl dehydrogenated tallow quaternary ammonium chloride dispersed in silicone oil. Focused-ion beam scanning electron microscopy shows that both C15A and EBF clays have sheet-like morphologies, but the sheets are more compact in the case of EBF clay. The rheological behavior of different suspensions was characterized by using a rheometer. The EBF suspensions behaved like Bingham fluids and also exhibited higher degrees of viscoelasticity than the C15A suspensions. The Casson model used to calculate the data of the yield stresses for the EBF suspensions was found to fit quite well with the flow curve results. The EBF suspensions obeyed the Schwarzl relation, in which the relaxation modulus ($G(t)$) illustrated a plateau-like behaviour for EBF suspensions compared to the C15A suspensions.

ZUSAMMENFASSUNG:

Diese Arbeit beschreibt die rheologischen Eigenschaften von Suspensionen aus einem Silikonöl und unterschiedlichen Gehalten eines kommerziell erhältlichen Southern African Tons (Eccabond Fine, EBF), das mit Hexadecyltrimethylammoniumbromid modifiziert wurde, und eines Cloisite 15A (C15A), das mit dimethyldehydrogeniertem Talg und einem quaternärem Ammoniumchlorid modifiziert wurde. Die Anwendung der sogenannten Focused-Ion Beam-Rasterelektronenmikroskopie zeigt, dass beide C15A und EBF-Tone eine plättchenartige Morphologie besitzen, wobei die Plättchen im Falle des EBF-Tons kompakter sind. Das rheologische Verhalten unterschiedlicher Suspensionen wurde durch rheologische Messungen charakterisiert. Die EBF-Suspensionen verhielten sich wie ein Bingham-Fluid und wiesen auch eine stärkere Viskoelastizität als die C15A-Suspensionen auf. Das Casson-Modell wurde angewandt, um die Fließspannung der EBF-Suspensionen zu bestimmen, und stand in guter Übereinstimmung mit den Resultaten aus Fließkurven-Messungen. Die EBF-Suspensionen folgten der Schwarzl-Beziehung, wobei der zeitabhängige Relaxationsmodul $G(t)$ bei den EBF-Suspensionen ein Plateau aufwies im Vergleich zu den C15A-Suspensionen.

RÉSUMÉ:

Cet article discute les propriétés rhéologiques des dispersions dans de l'huile de silicone, d'argile commerciale d'Afrique du sud, Eccabond fine (EBF), modifié avec du hexadecyltrimethyl ammonium bromide, et des dispersions de Cloisite 15A (C15A) modifiée avec un ammonium quaternaire (diméthyle suif dé-hydrogéné). La microscopie d'électrons à balayage montre que les argiles de C15A et d'EBF possèdent une morphologie de plaque, mais que les plaquettes de l'EBF sont plus compactes. Le comportement rhéologique des différentes suspensions a été caractérisé à l'aide d'un rhéomètre. Les suspensions d'EBF se comportent comme des fluides de Bingham et présentent aussi de plus hauts degrés de viscoélasticité que les suspensions de C15A. Le modèle de Casson utilisé pour calculer les valeurs de contrainte seuil pour les suspensions d'EBF s'ajuste assez bien aux courbes d'écoulement. Les suspensions d'EBF suivent une relation de Schwarzl, dans laquelle le module de relaxation $G(t)$ montre un comportement de type plateau.

KEY WORDS: bentonite, silicone oil, organoclay suspensions, rheology

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