Multimethod 3D characterization of natural plate-like nanoparticles: shape effects on equivalent size measurements.

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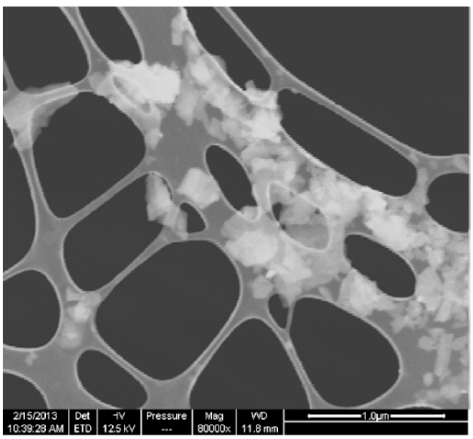
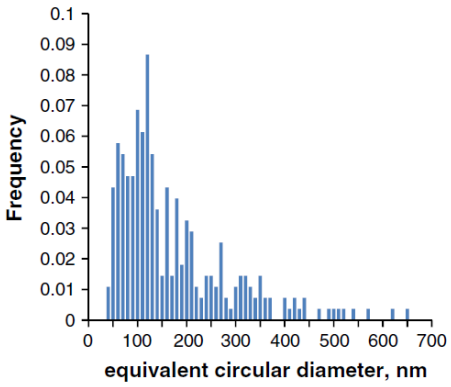
Abstract

The fundamental properties and processes that govern nanoparticle behavior in colloidal dispersions are critical to predict their performance in applications and also their environmental and health implications. Illite is a platy clay mineral that is present in large amounts in aquatic environments and can be used as a model natural particle for environmental risk assessment. However, the high-aspect ratio of illite makes conventional analysis, usually assuming a spherical size, insufficient for the assessment of shape-dependent properties. In the current paper, a multimethod characterization of a suspension of illite particles was done using atomic force microscopy, scanning electron microscopy, dynamic light scattering (DLS), nanoparticle tracking analysis, differential centrifugal sedimentation, and centrifugal-field flow fractionation coupled to multiangle light scattering and DLS. The relation between the different measurands was investigated, and the effect of the shape on the equivalent particle size was reported. While some of the used techniques are capable of assessing the aspect ratio of illite, the results confirm the need for multiple techniques and analysis of different types of measurands especially for high-aspect-ratio particles.

Fig. 3 Micrograph of the Illite particles on top of a hollow carbon grid as obtained with SEM and the corresponding histogram of equivalent circular diameters obtained from several micrographs (binwidth = 10 nm; $N = 277$). Overlapping plates were counted only if the contrast provided sufficient information to indicate the contour of the particle





Reference

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