Experimental Report

Proposal: **6-05-918** **Council:** 10/2012

Title: Collective motions on the picosecond time scale as a function of hydration level in hectorite clays.

This proposal is resubmission of: 6-05-902

Researh Area: Materials

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Samples: 3 natural hectorite

Instrument	Req. Days	All. Days	From	To
BRISP	15	12	16/07/2013	28/07/2013
IN4	5	5	31/07/2013	05/08/2013

Abstract:

The interaction of water with the surfaces of clay minerals has large effects, from the nano-scale to the meter-scale. The uptake of water into the interlayer spaces of smectites results in increased volume of the crystals; the collective motions of interlayer water may act additively to cause significant energy transmission. The collective motions of water under confinement, as for example in the interlayer spaces of clays, is thought to be anisotropic with respect to the crystal dimensions. We propose to analyze the collective motions of water in the smectite hectorite to gain a better understanding of the different conditions in which collective water motions occur in clays.

Report (BRiSP & IN4): In an attempt to differentiate any anisotropy of confined water in hydrated clay minerals, we designed and constructed sample cells which would allow us to probe both collective water aligned parallel with and perpendicular to the surfaces of the smectite hectorite. The aluminum sample cells had Al plate inserts that could be re-oriented to achieve a high cell surface area onto which the hydrated clay could expand against. The result was strong preferential alignment of clay platelets in both the parallel and perpendicular directions, thereby increasing the probability of observing anisotropy of collective water motions within the interlayer spaces of the smectite. For both BRiSP and IN4 measurements, samples were then measured in the dry state (105 C overnight under vacuum) and when hydrated at D_2O:clay ratios of 1:1 and 4:1.

Report BRiSP: Samples were measured at 300 K with an incident wavelength of 0.99 Å, covering a dynamic Q range of 0.2 to 1.3 $Å^{-1}$ with a FWHM of 2.7 meV. Samples were measured at 300 K.

Report IN4: Two different incident wavelengths, 1.1 and 2.2 Å, respectively corresponding to energy resolutions of 3.7 and 0.8 meV (FWHM) were used. Samples were measured at 300 K.

The experiments were successful and the data are being analyzed.