Heat Capacity Studies of Water on Nanoparticle Surfaces vs. Crystalline Hydrates

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We have made heat capacity measurements on nanoparticles of metal oxides (rutile and anatase phases of titanium dioxide and akaganéite: beta-FeOOH) with large quantities of surface water and on the dihydrate and anhydrous forms of crystalline guanosine over a large temperature region, 0.5 to 350 K. From these measurements, we have observed some common behavior for outer layers of surface water compared to inner layers of water. The outer water layers show glass transition like behavior above 150 K while the inner water layers have lower heat capacity than bulk water. On the contrary, the heat capacity of water in the crystalline hydrate resembles that of bulk ice (and its extrapolation above 273 K). Our results on nanoparticles support the conclusions from quasi-elastic neutron scattering studies of the dynamics of surface water on zirconium oxide [1] and cerium (IV) oxide [2]. The neutron studies on cerium (IV) oxide observed a change in the relaxation dynamics below 215 K which the authors claim is evidence for a fragile-to-strong liquid transition.

[1] Mamontov, *J.Chem.Phys.* **123,** 024706 (2005).
[2] E. Mamontov, *J.Chem.Phys.* **123,** 171101 (2005).