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Dynamics of water molecules on the surface of iron oxide nanoparticles: A QENS study

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In many applications like in biomedicine, ferrofluids, or heterogeneous catalysis, iron oxide nanoparticles (IONPs) feature a solid-liquid interface with the wetting water molecules. The interfacial properties including dynamics play an important role, yet have been barely addressed so far. Quasielastic neutron scattering (QENS) can access the dynamics of water molecules at the surface of TiO2, CuO, SnO2, and BaSO4 nanoparticles as shown in ref. 1-3. However, the water dynamics on the surface of magnetic IONPs are largely unknown.

We will report on QENS experiments performed at IN16B at ILL on IONP samples synthesized according to Ref 4 and stabilized at 8 % (nominally water-free) and 75 % (about two layers of water molecules) relative humidity (RH). Based on fixed window scans and energy-resolved spectra in the temperature range of 2 –334 K over a Q-range of 0.19 –1.83 Å-1, we aim to identify possibly coexisting diffusional modes of water molecules and the stabilizing citrate molecules at the IONP surface by analyzing the Q-dependency of the quasielastic intensity when comparing the nominally dry (8 %RH) and wet (75 %RH) sample. Possible contributions of superparamagnetic relaxations will be considered in the data analysis process as well.

References:
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