Small angle and inelastic scattering investigation of nanodiamonds

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Nanodiamond material (~5 nm diameter diamond particles) has the potential to be used in the design of the next generation of cold neutron sources (CNS). It is hoped that a blanket layer of this material surrounding the CNS moderator vessel will reflect very cold neutrons back into the moderator, thus reducing leakage through the vessel wall. In this work nanodiamonds produced by two different techniques have been studied, namely those prepared by the detonation method and by laser ablation of a carbon-hydrocarbon mixture.

The analysis of experimental data from USANS, SANS and SAXS measurements performed at Australia's OPAL reactor suggests that large scale structure such as clustering or aggregation of nanodiamond particles may be determining the scattering.

The generalised density of states (GDOS) obtained at 20 K from TOF inelastic neutron scattering measurements showed no low energy states. The GDOS of heated and unheated samples at 300 K are consistent with the proposition that thermal treatment of nanodiamond samples eliminates hydrogen in the form of water absorbed on the nanoparticle surface. Hydrogen bonded to carbon is difficult to remove by thermal treatment.