Aggregate Structure in Concentrated Liquid Dispersions of Ultrananocrystalline Diamond by Small-Angle Neutron Scattering

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Aggregates of nanodiamond particles dispersed in polar liquids (H_2O and DMSO) upon undergoing a special milling procedure are studied by small-angle neutron scattering at a scale of 1-100 nm. The size and fractal character of the aggregates, as well as the structural features of nanodiamond particles (size, surface) are compared for both solutions. The structural difference between liquid dispersions and initial nanodiamond powder is analyzed. The concentration effect is followed within an interval of 0.2-10 wt.% to conclude about the interaction of the aggregates. It is shown that the developed structure of the aggregates allows their interpenetration in concentrated solutions. The contrast variation procedure using mixtures of non-deuterated and deuterated solvents is performed to judge about the homogeneity of the aggregates and to find out their mean scattering length density. The existence of a non-diamond component in the particles is discussed basing on the scattering data.