

Small angle X-Ray scattering as a method to determine the shape and size distribution of nanodiamond particles. Comparison with dynamic light scattering

Kurkin T.^{a*}, Ozerin A.^a, Kechek'yan A.^a, Gritsenko O.^a,
Sustchev V.^b, Dolmatov V.^b

^a*Institute of Synthetic Polymeric Materials, Moscow, 117393, Russia*

^b*JSC "Diamond centre", St.-Petersburg, 193177, Russia*

**e-mail: t.kurkin@gmail.com*

Small angle X-Ray scattering (SAXS) can yield an essential information about the structural features and size of nanodiamond aggregated particles within the size range of approximately 1-100 nm. In some cases it is even possible to obtain the «averaged» structure of the single particle either under certain symmetry restrictions or without any (P1 symmetry class). Using SAXS it is also possible to estimate the specific surface area of the particles and calculate their volume-weighted (and number-weighted) size distribution either in colloid solution or in bulk material. However, the size distribution data obtained from SAXS does not always properly correlate with data obtained via dynamic light scattering methods (DLS), which often obscures the interpretation of entire data array. There are several major reasons causing this, but one of the most important is that the traditional dynamic light scattering techniques such as photon-correlation spectroscopy are generally applicable only at the very low concentrations of carbon particles in a solution. However, the design of new hybrid materials often requires much higher concentrations of the dispersed carbon nanoparticles to be analyzed. One of the efficient approaches in this case is to use «reverse» DLS with heterodyne signal processing procedure. In this case it is generally possible to obtain satisfactory correlation between SAXS and DLS.

In the presented contribution the application of both SAXS and «reverse» DLS techniques for characterization of nanodiamond solutions with varied pH range is demonstrated. The described techniques are also used to evaluate the influence of high-power ultrasonic treatment on the size distribution function of the particles, which was proven to be ambiguous in some cases.