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Kinetics of fullerene aggregation in polar liquids and their mixtures with water

Fullerenes, a new allotropic form of carbon discovered at the end of last century, provoke much interest partly due to their ability to dissolve in various liquids and the interesting effects that occur in their solutions [1]. These effects include clusters formation and growth, solvatochromism and some others.

The present report is dedicated to theoretical and experimental investigation of fullerenes aggregation in polar solutions. Slow growth of large fullerene clusters has been reported to occur in these systems [2]. It is supposed to be connected with formation of charge-transfer complexes between fullerene and solvent molecules [3]. We consider novel experimental data for C₆₀/N-methyl-pyrrolidone (NMP) solution, including DLS and UV-Vis kinetic measurements. For theoretical description of aggregation a model system similar to C₆₀/NMP is considered and the approach based on kinetic theory of nucleation has been developed. The cluster-size distribution functions within the model of limited growth are obtained for the whole period of systems evolution.

Using the developed approach we also consider the critical effect of cluster decomposition in C₆₀/NMP solution, that occurs after water addition to the system [4]. This effect may be used in the future for obtaining of fullerene-water solutions with given properties for biomedical applications. The possible models for description of the effect are discussed.

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