

DSC of «C₆₀ - H₂O» system: Unexpected Peaks

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Biological applications of fullerenes are hindered because of the poor solubility of C₆₀ in water. In this study the molecular-colloidal solution of hydrated C₆₀ in water (FWS = «fullerene-water-system») was investigated [1].

The general method of the FWS production is based on transferring of fullerenes from organic solutions into the aqueous phase with the help of ultrasonic treatment [2]. In our cases the different samples of C₆₀FWS with the C₆₀ concentration more then 4.0 mM (2.9 mg/ml) have been produced.

The resulting solutions were studied by UV, dynamic laser scattering, IR and etc. The most unexpected result was obtained by Differential Scanning Calorimetry (DSC). After precipitation and partial drying C₆₀ from FWS, the brown wet mixture, containing mostly C₆₀ and water, was isolated and scanned by means of DSC.

In addition to the huge peak at 273 K, which corresponded to the melting of water, one more easily reproducible endotherm was seen on the DSC trace at 270.7 K. The similar peak was observed on the trace of the «C₆₀-D₂O» system at temperature 273.4 K. Possible explanations of the peaks found were supplied.

The observed facts are discussed in an attempt to find a proper explanation for the unexpected stability of the FWS, namely, aqueous solutions of both isolated C₆₀ molecules in hydrated state, C₆₀@{H₂O}_n, and their small spherical clusters of different sizes.

1. G.V. Andrievsky, V.K. Klochkov, E.L. Karyakina, N.O. Mchedlov-Petrosyan, Chem. Phys. Lett. 300 (1999) 392.
2. G. Andrievsky, M. Kosevich, O. Vovk, V. Shelkovsky, L. Vashenko, J. Chem Sos., Chem. Commun. 1995, 1281.