

# THEMODYNAMIC CHARACTERISTICS OF THE DISSOLUTION OF FULLERENE C<sub>60</sub> IN BENZENE. SOME OF ITS DERIVATIVES AND CARBON DISULFIDE AT DIFFERENT TEMPERATURES

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**Abstract.** Currently, one of the most developing areas of modern chemistry is the study of fullerenes and their derivatives. An analysis of the literature has now revealed numerous works aimed at establishing the regularities of the processes of dissolution and solvation of fullerenes, the influence of temperature on them. At the same time, there is insufficient data on the anomalous temperature dependence of fullerene C<sub>60</sub> in organic solvents, the enthalpy of dissolution of this substance in organic solvents is single, obtained with a large error or completely absent. For scientists, such studies are primarily of practical interest. It is obvious that the establishment of the mechanism of solvation of fullerenes will make it possible to create optimal and modern methods of selective reactions with their participation, as well as to solve problems related to the management of the process of cluster formation of fullerenes.

Purpose of the work: determination of thermodynamic characteristics of the dissolution of fullerene C<sub>60</sub> in benzene, toluene, o-xylene, chlorobenzene, o-dichlorobenzene, brombenzene and carbon disulfide at different temperatures.

Research objectives:

- 1) Measure the enthalpy of dissolution of fullerene C<sub>60</sub> in benzene, toluene, o-xylene, chlorobenzene, brombenzene, o-dichlorobenzene, carbon disulfide at 298.15 K;
- 2) Measure the enthalpy of dissolution of C<sub>60</sub> in toluene, o-xylene and o-dichlorobenzene at 288.15 and 308.15 K;
- 3) Determine the standard enthalpy of dissolution for all studied systems;

- 4) To obtain a complete thermodynamic characteristic of dissolution (standard enthalpy, Gibbs energy and entropy) in seven solvents at 298.15K, for three systems – at 288.15 and 308.15K;
- 5) To establish the fact of changing the sign of the enthalpy of dissolution of fullerene C<sub>60</sub> in toluene, o-xylene, o-dichlorobenzene from minus to plus in the temperature range of 298.15 - 308.15K;
- 6) To establish correlations between the thermochemical characteristics of the dissolution of C<sub>60</sub> and the dipole moments of solvent molecules;
- 7) Questions of the features of solvation of C<sub>60</sub> in the studied liquid systems.

Scientific novelty of the work:

- 1) The enthalpy of dissolution of C<sub>60</sub> in benzene, toluene, o-xylene, o-dichlorobenzene, chlorobenzene, brombenzene and carbon disulfide were measured for the first time at three temperatures and the fact of changing the sign of the enthalpy of dissolution in the temperature range 288.15 – 308.15 K was established;
- 2) For the first time, a complete thermodynamic characteristic of the dissolution (Gibbs energy, enthalpy, entropy) of C<sub>60</sub> in seven solvents at 298.15 K was obtained;
- 3) Correlations have been established between the thermochemical characteristics of the dissolution of C<sub>60</sub> and the dipole moments of solvent molecules.

The practical significance of the work lies in obtaining high-precision, reliable thermochemical data that can be used for scientific and practical purposes.

The following provisions are submitted for protection:

1. Results of measurement of enthalpy of dissolution of C<sub>60</sub> in benzene, toluene, o-xylene, o-dichlorobenzene, chlorobenzene, brombenzene, carbon disulfide at 298.15 K.
2. Results of measurement of enthalpy of dissolution of C<sub>60</sub> in toluene, o-xylene, o-dichlorobenzene at 288.15 K and 308.15 K.
3. Standard values of enthalpy of dissolution of C<sub>60</sub> in the studied solvents.

4. Thermodynamic characteristics of  $C_{60}$  dissolution in the studied solvents.
5. Questions of the features of solvation of  $C_{60}$  in the studied liquid systems.