

## Solubility behaviour of C<sub>60</sub> in N-methylpirrolidon

Shiliaeva L.A.<sup>1</sup>, Korobov M.V.\*<sup>1</sup>, Avdeev M.V.<sup>2</sup>, Senyavin V.M.<sup>1</sup>,  
Semenyuk P.I.<sup>3</sup>

<sup>1</sup>Department of Chemistry, Moscow State University, 119899, Moscow, Russia

<sup>2</sup>Joint Institute for Nuclear Research, Dubna, Moscow reg., Russia

<sup>3</sup>Department of Bioengineering and Bioinformatics, 119991,

Moscow State University, Moscow, Russia

\*e-mail:mkorobov49@gmail.com

Solubility of C<sub>60</sub> in N-methyl-2-pyrrolidon (NMP) is a puzzle. It has long been known that UV-visible spectrum of C<sub>60</sub>-NMP solution undergoes dramatic change in time [1]. This change may be attributed to the formation of C<sub>60</sub> van-der-Waals clusters/C<sub>60</sub>-NMP charge transfer complexes in the solution. Reasonable mechanism of the process is not established so far.

This study was focused on the stability of C<sub>60</sub> monomers in NMP. Almost saturated concentration of monomers in NMP was obtained by gentle dissolution of C<sub>60</sub> or by its extraction from alkenes. Monomers were easily extracted from NMP to alkenes (hexane, cyclohexane and octane) and back from alkenes to NMP. Extinction coefficients for C<sub>60</sub> monomers in NMP were determined at different wavelengths. Abrupt fall of monomer's concentration in saturated solution is due to interaction of NMP with the surface of solid C<sub>60</sub>. After addition of fresh solid C<sub>60</sub> monomeric species re-appear in the solution.

Simple kinetic model was put forward to account for the results obtained. It involves successive processes of dissolution of C<sub>60</sub> in the form of monomers, step aggregation of C<sub>60</sub> in NMP, slow process of interaction of C<sub>60</sub> with NMP, which terminates both growth of C<sub>60</sub> clusters in the solution and dissolution of solid C<sub>60</sub>.

The model represents evolution of UV-spectra of C<sub>60</sub> – NMP saturated solution in time to a reasonable degree of approximation.

- [1] Yevlampieva N.P., Biryulin Yu.F., Melenevskjaja E.Yu. et al., *Colloids and surfaces A* **209**, 167 (2002).