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Temperature And Concentration Dependencies Of Density And Viscisity For The Fullerene C_{60} Solutions In O-Xylene

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Nowadays application of nanotechnology is one of the most promising ways to improve the efficiency of energy equipment. The additives of nanoparticles increase the thermal conductivity, saturated vapor pressure, decrease the surface tension and may enhance the heat transfer processes with and without phase change. Moreover, it has been shown that nanoparticles like fullerenes contribute to the reduction of the friction in the mating parts and increase the energy efficiency of the vapor compression refrigeration machines [1]. However, despite these advantages, the prospects of fullerenes usage in power equipment remain insufficiently studied. The temperature and concentration dependences of density and viscosity of the solutions containing fullerenes at low concentration remain insufficiently studied. Furthermore, physical mechanisms behind those effects have not been fully studied.

This study presents an experimental results for the density and viscosity of o-xylene/fullerenes C_{60} solutions. The experiments were carried out in the temperature range 280-350 K and concentrations up to 0.47 mass%. The density measurements of were carried out using a variable volume pycnometer with an uncertainty of ±0.0010 cm^3 (0.13%). The viscosity was measured by the capillary viscometer with a suspended level with an uncertainty of 0.5%.

The performed analysis indicate to a similarity between the concentration dependence of the density and viscosity of the investigated samples. At the concentrations up to 0.05 mass%, the density and viscosity of the solutions o-xylene/fullerenes C_{60} decreases as compared to pure o-xylene (on isotherms). At the concentrations of fullerenes higher than 0.05%, the density and viscosity of the solutions o-xylene/ fullerenes C_{60} increases.

Based on the experimental results, we can conclude that the concentration dependence of the density and viscosity of the solutions o-xylene/fullerenes C_{60} is determined by two factors: fluctuational (up to 0.05 mass% of fullerenes) and concentrational (when concentration of C_{60} is higher than 0.05 mass%).

1. Ku B.C., Han Y.C., Lee J.E., Lee J.K., Park S.H. Tribological effects of fullerene (C60) nanoparticles added in mineral lubricants according to its viscosity // Int. J. Precis. Eng. Man. 2010. Vol. 11. P. 607-611.