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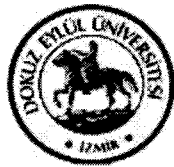
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## **Effect Of Fullerenes C60 On Heat Capacity, Density, Thermal Conductivity And Viscosity Of Tetralin**

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One of the promising ways to improve the efficiency of solar power plants is the use of nanofluids instead of the traditional working fluids. To achieve the maximum efficiency of solar power plants, researchers pay considerable attention to both the thermophysical properties of working fluids and their ability to absorb solar energy. The use of nanotechnology allows purposefully to change thermophysical properties of high-temperature working fluids and to regulate the absorptive capacity of the rays of the sun. Moreover, the additives of nanoparticles to the working fluid may enhance the heat transfer processes in the heat exchange equipment. Thereafter, it results in decrease of their mass and dimensions, and consequently costs reduction for equipment production. Therefore, the influence of perspective types of nanoparticles, their size and concentration on the thermophysical properties of working fluids remains relevant.

Tetralin (CAS 119-64-2) has been previously used as a coolant in nuclear power plants [1]. Thus, it can be considered as a promising high-temperature working fluid for solar energy due to its appropriate thermophysical properties and the ability to dissolve carbon nanoparticles. However, thermophysical properties of the solutions of tetralin with fullerenes C<sub>60</sub> are still not studied.

In present study the experimental results for the density, viscosity and heat capacity of tetralin/fullerene C<sub>60</sub> solutions are reported in the temperature range from 280 K to 450 K and in the range of fullerenes concentrations up to 0.6 mass%. The density measurements of tetralin/C<sub>60</sub> were carried out using a variable volume pycnometer with an uncertainty of 0.12%. The viscosity was measured by the capillary viscometer with a suspended level with an uncertainty of 0.5%. The isobaric heat capacity was measured on a variable-temperature adiabatic calorimeter with an uncertainty of 0.5%. Thermal conductivity was measured using an experimental setup that implements the transient hot-wire method. Tantalum wire with a diameter of 25 µm and a length of 71 mm was used as a sensing element. Thermal conductivity experiments were carried out in the temperature range from 290 to 340 K and in the range of fullerenes concentrations up to 0.7 mass% with an uncertainty of 3%.

Based on the experimental results, it was shown, that the additives of fullerenes contribute to an slightly increase the density and decrease the heat capacity (up to 2.3 %) of tetralin. The effect of fullerenes C<sub>60</sub> on thermal conductivity does not exceed 1.2%. The viscosity of tetralin with 0.5 mass % of C<sub>60</sub> can be either lower than viscosity of pure tetralin at temperature below 350 K (up to 2 %), or higher the viscosity of tetralin when temperature more than 350 K (up to 1 %). Consequently, the report provides an analysis of the temperature and concentration dependences of the studied properties of tetralin/C<sub>60</sub> solutions.

Keywords: Tetralin/fullerenes C<sub>60</sub>, Density, Heat capacity, Thermal conductivity, Viscosity

1. Chikazawa, Y., Farmer, M., & Grandy, C. (2009). Technology gap analysis on sodium-cooled reactor fuel-handling system supporting advanced burner reactor development. *Nuclear Technology*, 165(3), 270-292.