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Effect of Particles Size and Volume Fraction Concentration on the Thermal Conductivity and Thermal Diffusivity of Al2O3 Nanofluids Measured Using Transient Hot–Wire Laser Beam Deflection Technique

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Abstract : In this study we present new data for the thermal conductivity enhancement in four nanofluids containing 11, 25, 50, 63 nm diameter aluminum oxide (Al2O3) nanoparticles in distilled water. The nanofluids were prepared using single step method (i.e. by dispersing nanoparticle directly in base fluid) which was gathered in ultrasonic device for approximately 7 hours. The transient hot-wire laser beam displacement technique was used to measure the thermal conductivity and thermal diffusivity of the prepared nanofluids. The thermal conductivity and thermal diffusivity were obtained by fitting the experimental data to the numerical data simulated for aluminum oxide in distilled water. The results show that the thermal conductivity and thermal diffusivity of nanofluids increases in non-linear behavior as the particle size increases. While, the thermal conductivity and thermal diffusivity of Al2O3 nanofluids was observed increasing linearly with concentration as the volume fraction concentration increases. We believe that the interfacial layer between solid/fluid is the main factor for the enhancement of thermal conductivity and thermal diffusivity of Al2O3 nanofluids in the present work.

Keywords : transient hot wire-laser beam technique, Al2O3 nanofluid, particle size, volume fraction concentration
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