Measurement of Thermophysical Properties of CNT/DI Water Nanofluids

Joohyun Lee [C, S] and Daeho Kim
Center for Thermometry, Korea Research Institute of Standards and Science, Daejeon, Korea
joohyun.lee@kriss.re.kr

Nanofluids, which are liquids containing nanoparticles in traditional heat transfer liquids have been reported to have significant thermal conductivity increase over the past decade. In this study, thermophysical properties of a CNT/DI water nanofluid are experimentally investigated. To prepare the nanofluid, CNT and DI water were mixed and some amount of Gum Arabic was added as a surfactant. Ultrasonication was applied for several hours to break possible agglomeration. The thermal conductivity of the nanofluid was measured using the transient-hot-wire technique. The natural convection effect, which is a main reason of inaccurate measurements in the THW, was effectively eliminated by using a smaller cell and by using appropriate data selection. The specific heat of the prepared nanofluid was measured with a BT 2.15 Calvet calorimeter from 15 °C to 70 °C and density was measured with a DMA 5000 density meter. The heat transfer coefficient was also measured to confirm the convection performance of the nanofluid. A stainless steel tube with 1/4“ (0.635 cm) in outside diameter and 2 m in length was used for the experiment, and the first 1 m was used to make hydraulically fully developed flow. The remaining 1 m was heated by passing current and a constant heat flux condition was achieved. Ten T-type thermocouples are installed on the outside wall of the tube offering temperature data. The experimental results showed that the thermal conductivity of 2 weight percent concentration a CNT/DI water nanofluid was increased by 14 % and the heat transfer coefficient was increased by 23 %. The specific heat and density did not show notable change. A simulation was conducted to explain the thermal conductivity increase of the nanofluid and the high aspect ratio of the CNT turned out to be a possible factor.