Thermal performance of carbon nanotube nanofluids in solar microchannel collectors: An experimental study

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Many studies show that nanofluids, especially with carbon nanotubes, improve heat transfer. Other studies show that a nanofluid is a good candidate for solar systems because of its good absorptivity. We are facing an increasing number of miniaturized and more powerful systems. Especially in microelectronics, small heat sinks with high heat transfer are being developed, called micro-channel heat sinks (MCHS). In this paper, the heat transfer behavior of carbon nanotube–water nanofluid in a microchannel solar collector is studied experimentally. The exchanger is composed of 16 micro-channel hydraulic diameters of 1 mm and a glass or quartz cover with a surface area of 25 cm2. Solar radiation is simulated by a halogen lamp. The experimental set-up includes a solar meter, pressure, and temperature sensors, and it is allowed to control the flow. The nanofluid is a solution of water containing a 0.01%, 0.05%, 0.1%, and 0.5% weight fraction, respectively, of the carbon nanotubes, which are 9.2 nm in diameter and 1.5 μm in length. Viscosity and density are measured experimentally. The evolution of efficiency and the pressure drop are presented according to the Reynolds number and are compared with the results obtained with distilled water.