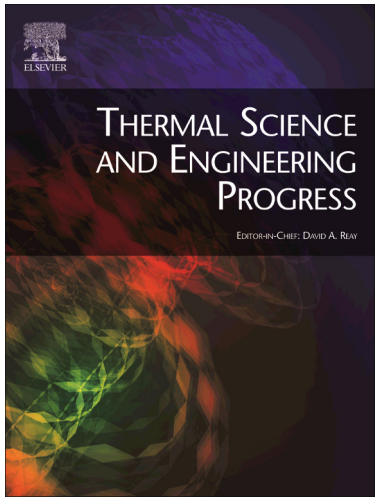

Thermal performance enhancement of flat-plate solar collectors by means of three different nanofluids

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THERMAL PERFORMANCE ENHANCEMENT OF FLAT-PLATE SOLAR COLLECTORS BY MEANS OF THREE DIFFERENT NANOFLUIDS

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Abstract

Solar energy, which comes first among renewable energy sources, enables efficient use of energy with many applications due to its low operating cost and environmental friendliness. In this study, we experimentally investigated the effects on thermal efficiency of nanofluid and water as working fluids in flat-plate solar collector hot water solar energy systems. Nanofluids were prepared by adding AI2O3, CuO, and TiCte nanoparticles at 0.2, 0.4, and 0.8 vol. % into distilled water, and then the thermophysical properties (thermal conductivity, viscosity) of the prepared nanofluids were determined. Flow rate was adjusted to 250 1/h at given concentrations for each nanofluid in the experimental setups and data such as collector inlet and outlet temperatures, ambient and tap water temperatures; radiation, humidity, and wind speed were measured and recorded. The obtained data were used to calculate efficiencies according to ASHRAE 93-2003 standards. When compared with water, the results indicated that the use of nanofluid increased collector efficiency. **Keywords:** nanofluid, efficiency, nanoparticles, solar collector

1. Introduction

Energy demand, which is one of the most important inputs of everyday life, is constantly increasing, and energy resources are rapidly being consumed. In that respect, it is important to develop new methods to take increasing advantage of limited energy resources by reconsidering current energy conversion systems. Because the performances of heat-transfer fluids traditionally used in such applications, such as water, synthetic oils, and ethylene glycol (antifreeze) are poor, those fluids limit studies aiming at improving heat transfer. Therefore, in recent years, researchers have studied new-generation heat transfer fluids. Today nanotechnological developments, such as micro emulsion techniques and manufacturing methods from the gas phase such as inert gas condensation, chemical vapor condensation, and hydrogen reduction allow metallic particles to be produced in nanoscale. Thus the addition of particles into fluids has become a current issue (Maxwell, 1881; Gurmen