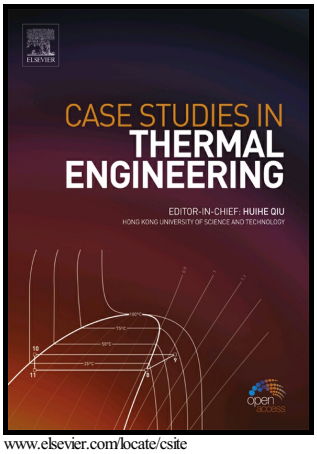
Author's Accepted Manuscript



www.elsevier.com/locate/csite

Numerical study on the effect of operating nanofluids of photovoltaic thermal system (PV/T) on the convective heat transfer

Ali H.A. Al-Waeli, Miqdam T. Chaichan, Hussein A. Kazem, K. Sopian, Javad Safaei

PII: S2214-157X(18)30126-6
DOI: https://doi.org/10.1016/j.csite.2018.05.011
Reference: CSITE301

To appear in: *Case Studies in Thermal Engineering*

Received date: 4 May 2018
Revised date: 22 May 2018
Accepted date: 29 May 2018

Cite this article as: Ali H.A. Al-Waeli, Miqdam T. Chaichan, Hussein A. Kazem, K. Sopian and Javad Safaei, Numerical study on the effect of operating nanofluids of photovoltaic thermal system (PV/T) on the convective heat transfer, *Case Studies in Thermal Engineering,* https://doi.org/10.1016/j.csite.2018.05.011

Numerical study on the effect of operating nanofluids of photovoltaic thermal system (PV/T) on the convective heat transfer

Ali H.A. Al-Waeli[a], Miqdam T. Chaichan[b], Hussein A. Kazem[c]*, K. Sopian[a], Javad Safaei[a]

[a]Solar Energy Research Institute, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia
[b]Energy and Renewable Energies Technology Center, Iraq
[c*]Sohar University, PO Box 44, Sohar PCI 311, Oman

Abstract

Photovoltaic (PV) collectors are replaced with hybrid photovoltaic thermal (PV/T) systems to establish an electrical and thermal yields. The main function of such design is to provide cooling for the solar cell by absorbing its temperature. This temperature is used for the thermal energy generation of this hybrid design. High electrical and thermal efficiencies are associated with PV/T's. In this study, mathematical analysis was used to examine the effect of the type of nanoparticles added (SiC, CuO, and Al2O3), and the type of base fluids (water, glycerin, and ethylene glycol) on the convection heat transfer of PV/T system. The solar simulator type 'MINI-EESTC' was modified to work as a PV/T was used in the practical part of the study.

The numerical results showed the base fluid and the added nanoparticles' thermophysical properties effect on the convective heat transfer and pressure drop. Glycerin showed the maximum pressure drop while water indicated the minimal value. The addition of nano-SiC for the studied base-fluids afforded higher convective heat transfer than nano-CuO and nano-alumina. The validation of the numerical results with the practical one showed a good agreement.

Keywords: PV/T; nanofluids; Solar energy; Solar systems; Heat transfer enhancement

Nomenclature

A	Area (m^2)
Al2O3	Aluminum oxide
Cu	Copper