Efficiency enhancement of building multi-layer solar collector with SiO_2–TiO_2 hybrid nanofluids

Building Simulation • Article • 2023 • DOI: 10.1007/s12273-022-0979-8

Zawawi N.N.M. [a]; Azmi W.H. [a, b]; Majid Z.A.A. [c]; Rahim R.A. [d]; Ali H.M. [e, f]

[a] Lebuhraya Tun Razak, Centre for Research in Advanced Fluid and Processes, Gambang, Kuantan, Pahang, 26300, Malaysia

Abstract

Due to the depletion of conventional energy sources and its limitless resources, solar energy is currently being considered as a viable alternative, especially for water heating systems. The thermal performance of multilayer solar collectors for water heating systems can be improved further by introducing hybrid nanofluids as advanced fluids. This study demonstrates the utilisation of hybrid nanofluids in heating systems by employing a multilayer absorber solar collector. The SiO_2–TiO_2 hybrid nanofluids at volume concentrations up to 2.0% were tested at various flow rates (1.7 to 3.7 LPM) and solar radiation intensities (250 to 1000 W/m^2). The thermal performance of the solar collector was assessed by measuring the temperature variation, heat loss, and overall efficiency of the collector. At the optimal volume concentration, the temperature difference for solar collectors

employing SiO_2–TiO_2 hybrid nanofluids increased significantly. The optimal volume concentration of 1.5% yields a maximum temperature difference of 9.5 °C. In addition, the efficiency and fluid temperature of the solar collector containing hybrid nanofluids have been enhanced by 22% and 37%, respectively. The SiO_2–TiO_2 hybrid nanofluids with the optimal volume concentration of 1.5% were therefore recommended for maximum efficiency in the solar collector. © 2023, Tsinghua University Press.

Author keywords

hybrid nanofluids; solar collector; solar simulator; solar water heating system; thermal efficiency

Indexed keywords

Engineering controlled terms

Collector efficiency; Multilayers; Nanofluidics; Silica; Silicon; Solar absorbers; Solar energy; Solar heating; Solar water heaters

Engineering uncontrolled terms

Conventional energy sources; Efficiency enhancement; Hybrid nanofluid; Multi-layers; Solar simulator; Solar water heating systems; Thermal Performance; Thermal-efficiency; Volume concentration; Water heating systems

Engineering main heading

Titanium dioxide

Funding details

Details about financial support for research, including funding sources and grant numbers as provided in academic publications.

Funding sponsor	Funding number	Acronym
Advanced Automotive Liquids Laboratory		
Centre for Research in Advanced Fluid and Processes		
Universiti Malaysia Pahang See opportunities by UMP	RDU213302	UMP

Funding text

The authors are appreciative for the financial support provided by Universiti Malaysia Pahang under International Publication Grant (RDU213302). The authors further acknowledge the contributions of the research teams from the Centre for Research in Advanced Fluid and Processes (Pusat Bendalir) and the Advanced Automotive Liquids Laboratory (AALL), who gave valuable insight and expertise to the current study.

Corresponding authors

Corresponding author	W.H. Azmi
Affiliation	Lebuhraya Tun Razak, Centre for Research in Advanced Fluid and Processes, Gambang, Kuantan, Pahang, 26300, Malaysia
Email address	wanazmi2010@gmail.com
Corresponding author	H.M. Ali
Affiliation	Mechanical Engineering Department, King Fahd University of Petroleum and Minerals, Dhahran, 31261, Saudi Arabia
Email address	hafiz.ali@kfupm.edu.sa

Abstract

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