Study on Selection of a Suitable Material and The Parameters for Designing a Portable Flat Plate Base-Thermal Cell Absorber (FPBTCA)

Journal of Advanced Research in Fluid Mechanics and Thermal Sciences • Article • *Open Access* • 2021 •
DOI: 10.37934/arfmts.85.1.7192

Harun, Muhammad Amin [a]; Majid, Zafri Azran Abdul [b]; Zakaria, Zairul Azrul [a]; Ismail, Ahmad Faris [a]; Ihsan, Sany Izan [a]; +3 authors

[a] Kuliyyah of Engineering, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, 53100, Malaysia

Abstract

Several types of flat plate solar collectors have been designed and developed with various technical parameters involved in the design. The limitations of a flat plate solar collector are energy storage and design of flat plate absorber height and weight. An investigation on the effect of flat plate absorber-collector material, glass thickness, air gap distance and flat plate absorber base collector thickness on the performance of solar thermal collectors was conducted in this work. The results obtained will be used as the base to develop thermal cell application on flat plate solar collector. The experiment was performed using a solar simulator with solar radiation of 450 W/m^2 and 750 W/m^2. The results showed that 2.0 mm glass thickness yielded maximum flat plate absorber temperature (88.1 °C at t = 600 s), high heat gain rate (0.097 °C/s), and highest total heat gain (1207.33 J). The results also revealed that the air gap distance of 10.0 mm achieved maximum flat plate absorber temperature (64.6 C at t = 600 s), highest heat gain rate (0.058 C/s), and highest total heat gain (4750.92 J). The stainlesssteel thermal cell absorber thickness of 1.0 mm yielded thermal cell absorber temperature (76.2 C at t = 600 s) and high heat gain rate (0.08 C/s). The aluminum flat plate base absorber achieved the highest flat plate absorber temperature (67.2 C at t = 600 s) and the highest heat gain rate (0.062 C/s). Using double glass as glass cover increased the flat plate absorber temperature (76.3 C at t = 600 s) and highest heat gain rate (0.077 C/s). This research aims to produce a flat plate absorber with better energy storage, and with the performance of the stainless-steel plate absorber better than aluminum of the same thickness. Although the stainless-steel flat plate absorbercollector showed a lower temperature than aluminum, it had a higher temperature drop than the latter.

Author keywords

absorber base collector; flat plate solar collector (FPSC); thermal cell absorber

Reaxys Chemistry database information

Reaxys is designed to support chemistry researchers at every stage with the ability to investigated chemistry related research topics in peer-reviewed literature, patents and substance databases. Reaxys retrieves substances, substance properties, reaction and synthesis data.

Substances

AI

View details

Powered by Reaxys

Funding details

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

Funding sponsor	Funding number	Acronym
Kulliyyah of Allied Health Sciences		
RADTEC Enterprise		
SERI-UKM	RU-2019-001/1	
Universiti Kebangsaan Malaysia See opportunities		
International Islamic University Malaysia		IIUM

Funding sponsor	Funding number	Acronym

See opportunities by IIUM

Funding text

The authors wish to express their grateful acknowledgement to Kulliyyah of Engineering (KOE) and Kulliyyah of Allied Health Sciences (KAHS), International Islamic University Malaysia (IIUM) together with Solar Energy Research Institute, National University of Malaysia (SERI-UKM) for the use of laboratory facilities, as well as MRUN Research Grant (RU-2019-001/1) and RADTEC Enterprise for the financial support.

Corresponding authors

Corresponding author	Z.A.A. Majid
Affiliation	Kuliyyah of Allied Health Sciences, International Islamic University of Malaysia, 25200, Bandar Indera Mahkota Kuantan, Pahang, Malaysia
Email address	zafriazran@yahoo.com

Abstract

Author keywords

Reaxys Chemistry database information