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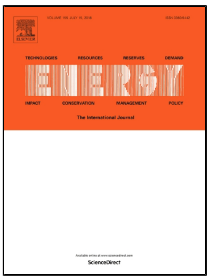

Experimental study on a novel photovoltaic thermal system using amorphous silicon cells deposited on stainless steel

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Jing Li[a,b], Xiao Ren[a], Weiqi Yuan[a], Zhaomeng Li[a], Gang Pei[a*], Yuehong Su[b], Kutlu Çağrı[b], Jie Ji[a], Saffa Riffat[b]

[a] *Department of Thermal Science and Energy Engineering, University of Science and Technology of China, 96 Jinzhai Road, Hefei, China*

[b] *Department of Architecture and Built Environment, University of Nottingham, University Park, Nottingham NG7 2RD, UK*

[*]Corresponding author. Tel. /Fax: +86 0551 63601652. E-mail: peigang@ustc.edu.cn

Abstract

Amorphous silicon (a-Si) cells are able to perform better as temperature increases due to the effect of thermal annealing. a-Si cells have great potential to solve or ease the problems of high power temperature coefficient, large thermal stress caused by temperature fluctuation and gradient, and thick layer of conventional crystalline silicon cell-related photovoltaic/thermal (PV/T) collectors. In this paper, an innovative a-Si PV/T system is developed. It is the first time that a-Si cells deposited on stainless steel have been used in a practical PV/T system. The system comprises of two PV/T collectors. In each collector, there are 8 pieces of solar cells in series. Long-term outdoor performance has been monitored. Experimental results on the thermal efficiency (η_{th}), electrical efficiency (η_{PV}) and I-V characteristic are presented. The peak instantaneous $\eta_{th,p}$ was about 42.49% with the maximum $\eta_{PV,p}$ of 5.92% on April 2, 2017. The daily average $\eta_{th,a}$ and $\eta_{PV,a}$ were 32.8% and 5.58%. Accordingly, $\eta_{th,p}$, $\eta_{PV,p}$, $\eta_{th,a}$ and $\eta_{PV,a}$ on October 27 were 43.47%, 5.69%, 38.65% and 5.22 %. During more than half a year operation, no technical failure of the system has been observed. The feasibility of the a-Si PV/T is preliminarily demonstrated by the prototype.