Investigation of a binary eutectic mixture of phase change material for building integrated photovoltaic (BIPV) system

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ABSTRACT

The incorporation of phase change material (PCM) into the building integrated semi-transparent photovoltaic (BISTPV) system is a promising technology to regulate the enhanced surface temperature of the photovoltaic (PV) system. In this work, Sodium Sulfate Decahydrate ($Na_2SO_4 \cdot 10H_2O$) and Zinc Nitrate Hexahydrate ($N_2O_6Zn \cdot 6H_2O$) were mixed to form the binary eutectic PCM by heating mixing method. The results of Differential Scanning Calorimeter (DSC) characterization of those eutectic mixtures showed that the molar mass proportion of 70% weight of $Na_2SO_4 \cdot 10H_2O$ and 30% weight $N_2O_6Zn \cdot 6H_2O$ was an optimum eutectic mixture for the solar energy applications. The developed eutectic mixture was employed in the specially designed and fabricated building-integrated semi-transparent photovoltaic phase change material (BISTPV-PCM) system to regulate BISTPV cell temperature. The experimentation was carried out at the outdoor environmental conditions in the region of Kovilpatti (9°10'0"N, 77°52'0"E), Tamilnadu, India throughout the year of 2018. The instantaneous peak temperature was reduced up to 12 °C for the BISTPV-PCM system compared to the non-PCM counterpart. The annual output power generated from the BISTPV module was 34,287 W h/year which increased to 37,024 W h/year by using PCM.

KEYWORDS

DSC; Eutectic PCM; Inorganic PCM; BISTPV; Glauber salt; BIPV

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