عنوان مقاله:

Thermal Behavior of Monocrystalline Silicon Solar Cells: A Numerical and Experimental Investigation on the Module Encapsulation Materials

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خلاصه مقاله:

This research outlines the numerical predictions of the heat distribution in solar cells, accompanied by their empirical validation. Finite element thermal models of five laminated silicon solar photovoltaic cells were firstly established using a simulation software (ANSYS®). The flexible laminated solar cells under study are made of a highly transparent frontsheet, a silicon cell between two encapsulants, and a backsheet. Different combinations of layers (i.e., materials and thicknesses) were taken into account in order to analyze their effect on thermal behavior. Thermal properties of materials were derived in accordance with the literature. Similarly, boundary conditions, loads, and heat losses by reflection and convection were also specified. The solar cells were tested using solar lamps under standard conditions (irradiance: ۱۰۰۰W/m۲; room-temperature: ۲۵°C) with real-time temperatures measured by a thermal imager. This analysis offers an interpretation of how temperature evolves through the solar cell and, consequently, how the design choice can influence the cells' efficiency.

کلمات کلیدی:

Photovoltaics, Solar Mobility, Solar Cell Efficiency, Transient Thermal Analysis, Finite Elements