Experimental exergy analysis of water-cooled PV module

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Abstract: The solar photovoltaic (PV) cell converts solar energy into electricity with a relatively low efficiency which is <15%. More than 80% of the absorbed solar energy is dumped into the surroundings as heat after photovoltaic conversion. The operating temperature of the photovolatic module should be maintained as low as possible to improve the efficiency. This research work proposes recycle water-cooled solar photovoltaic system design by using a mono-crystalline and amorphous silicon PV module as solar absorber. Recycle water cooling of a normal amorphous and crystalline PV module configured as water base solar PV system by forced flow is studied. The energy and exergy performance of the PV module has been experimentally determined at 3.5 l/min (210 l/h) mass flow rate. The experimental result shows that the water-cooled solar PV module has got better performance than the PV module without cooling. Around 4.5% of amorphous and 3.2% of mono-crystalline module energy efficiency improved on cooling along with 6.5% of amorphous and 5% of mono-crystalline module exergy efficiency improvement with respect to without cooling/normal solar PV module.