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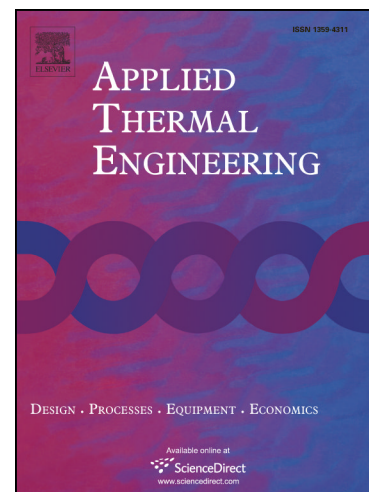
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High-Performance Solar Steam Generation of a Paper-Based Carbon Particle System

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Abstract: Solar steam generation systems have drawn widely interest for water purification to solve the fresh water shortage recently. In this work, a typical bi-layer system was prepared by daubing carbon particles on the air-laid paper (C-paper). The effects of the thickness of the air-laid paper film and the carbon particle concentration on the evaporation rate were investigated. Results turn out that: with the increase of the layers of papers, the evaporation rate increases initially until the paper film reaches a thickness of nine layers, and then saturates to a constant value. The thickness of nine layers of air-laid papers is optimum for enhancing the evaporation rate when more layers of papers could not further increase the evaporation rate. With the increase of the concentration of the carbon particles, the evaporation rate also initially increases rapidly and then gradually tends to a constant value, due to both of the limited ability of vapor passing through the top layer and the reduced light absorption capability of carbon particles induced by the stack of carbon particles. Applying the optimum thickness of the paper film and the optimum concentration of carbon particles in our C-paper system, the evaporation rate and the evaporation efficiency under a solar power illumination of $1 \text{ kW}\cdot\text{m}^{-2}$ can be respectively $0.964 \text{ kg}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$ and 70 %, which are close to the ones of the home-made CNT-paper and GO-paper systems. The C-paper is an excellent candidate for solar steam generation applications, thanks to its easy preparation, high efficiency and low cost.

Keywords: solar energy, carbon particle, steam generation, water purification

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