143b Heat and Mass Transfer in a Novel Copper Nanopowder/Silica Gel Bed

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In order to enhance the heat transfer performance, the consolidated copper nanopowder/silica gel layer is coated directly onto the surface of a metal heat exchanger in the adsorption cooling system. The copper nanopowder/silica gel-coated heat exchanger is employed as an adsorber for adsorption/desorption water vapor in the system. In this study, the mass transfer performance and thermal conductivity of the copper nanopowder/silica gel layer with different compositions were evaluated. From the results, the surface properties of silica gel were affected by adding the copper nanopowder. The specific surface area, pore volume, and average pore size were increased with the amount of additive. However, the change of surface properties became minor when the adding of copper nanopowders reached a specific amount. Besides, the heat transfer resistance was also affected by the amount of binder in the consolidated layer. The thermal conductivity of the silica gel was improved by adding the copper nanopowder and the binder. To compress the consolidated copper nanopowder/silica gel layer, the thermal conductivity of the layer was improved further. As expected, adding the copper nanopowder may increase the mass transfer resistance of the sorbent. A slight variation of the mass transfer resistance was observed. Therefore, the novel copper nanopowder/silica gel consolidated bed is applicable for the adsorption cooling system.

Keywords: adsorption cooling; thermal conductivity; composite sorbent; silica gel; copper nanopowder