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Mathematical modeling of the adsorption cooling reactor

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ABSRTACT

An over review of adsorption-desoption cycles will be introduced. A non-equilibrium mathematical model to represent the dynamics of the coupled heat and mass transfer within the adsorption reactor of the adsorption cooling system will be detailed. The model is derived from the basic principles of the mass and energy balance relations for a differential element in the adsorption bed. This element includes the adsorbate phase, the adsorbent solid, and the refrigerant vapor phase. Moreover, the linear driving force (LDF) equation which represents the non-equilibrium adsorption kinetics is merged with the derived equations. The spatial variation of pressure in the bed is very small and can be neglected. Besides, the boundary interfaces equations are introduced as well. The presented mathematical equations are general and therefore can be used to simulate both the tubular and the flat bed reactor configurations. Furthermore, the real physical properties of the refrigerant can be used in the equations through the refrigerant equation of state or its tabulated thermodynamic properties. Therefore, any combination of the adsorbate and adsorbent pairs can be represented with the given model.