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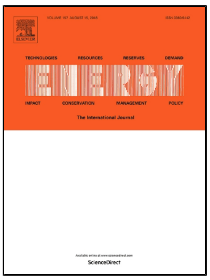

Experimental identification and thermodynamic analysis of ammonia sorption equilibrium characteristics on halide salts

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Experimental identification and thermodynamic analysis of ammonia sorption equilibrium characteristics on halide salts

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Abstract

Solid–gas chemisorption based on metal ammine complexes is a kind of promising energy-saving and environment-friendly technology for various thermal engineering applications such as chemical heat pump, thermochemical energy storage, chemisorption refrigeration, etc. The accurate thermodynamic parameters of ammonia sorption on halide salts can allow a significant theoretical and experimental study on a solid–gas chemisorption system using halide salt–ammonia sorption working pairs. In this study, the thermodynamic properties of chemisorption between strontium chloride ($SrCl_2$) and ammonia is firstly investigated by developing a facile methodology for sorption equilibrium measurement. The facile methodology involves the fabrication of incompact composite sorbent of expanded graphite/$SrCl_2$ with high porosity and an optimized temperature-controlling method so as to weaken the adverse effect of heat and mass transfer on chemisorption and realize the chemical equilibrium and thermal quasi-equilibrium during the isobaric measurement process. Through the experimental measurement, the stoichiometric equations of chemisorption between $SrCl_2$ and NH_3 are updated, and thermodynamic parameters including reaction enthalpy, reaction entropy and hysteresis are identified. Similarly, the thermodynamic characteristics of chemisorption between ammonia and halide salts $BaCl_2$, $SrBr_2$, and $MnCl_2$ are also investigated. The facile methodology is proved available for measuring the ammonia sorption equilibrium characteristics on halide salts. At last, the working performance of a cascade thermochemical energy storage system using four halides salts is analyzed based on the obtained thermodynamic parameters.

Key words: thermodynamic; ammonia sorption; strontium chloride; halide salts; hysteresis.

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