

Thermodynamic study of a combined double-way solid–gas thermochemical sorption refrigeration cycle

Etude thermodynamique d'un cycle frigorifique à sorption thermochimique solide/gaz

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Abstract

A combined double-way thermochemical sorption refrigeration thermodynamic cycle was proposed and tested. Both adsorption refrigeration and resorption refrigeration processes were combined in order to improve the system performance. Two different consolidated composite materials were used as the reactive sorbents and ammonia was used as the refrigerant. Experimental results showed that a system operating with such proposed cycle can have two useful cold productions during one cycle at the expense of only one heat input at high temperature. The average specific cooling power (SCP) during the adsorption refrigeration phase was 301 W kg^{-1} . Analysis of the experimental data showed that the driving equilibrium drop during the resorption process was much lower than that during the adsorption process, when the cold production temperature was similar. The proposed combined double-way sorption cycle has a larger cooling capacity per unit of heat input and the maximum theoretical coefficient of performance (COP) is 1.24 when MnCl_2 and BaCl_2 are used as the reactive sorbents.

Keywords

- Absorption system;
- Resorption system;
- Ammonia;
- Chloride;
- Barium;
- Manganese;
- Thermodynamic cycle;
- Study;
- Performance

Mots clés

- Système à absorption;
- Système à résorption;
- Ammoniac;
- Chlorure;
- Baryum;
- Manganèse;

- Cycle thermodynamique;
- Étude;
- Performance