Lithium chloride – Expanded graphite composite sorbent for solar powered ice maker

J.K. Kiplagat[a], ,R.Z. Wang[a,*], R.G. Oliveira[b], T.X. Li[a]

Abstract

Consolidated composite material made from expanded graphite (EG) powder impregnated with LiCl salt is proposed for use in solar powered adsorption ice makers. Laboratory experiments were done to test the adsorption and desorption performance of the sorbent under different temperature conditions suitable for solar energy utilization. More than 75% of the reaction between LiCl and ammonia was completed after 30 min of synthesis at evaporation temperatures of −10 and −5 °C and adsorption temperature between 25 and 35 °C. Under the same period, it was possible to obtain 80% conversion in the desorption phase, when the generation temperatures ranged between 75 and 80 °C, and the condensation temperature varied from 25 to 35 °C. The highest average specific cooling power during the synthesis phase was 117 W per kg of the block. The calculated theoretical coefficient of performance (COP) under different cycle conditions was nearly constant at 0.47. Moreover, the new composite sorbent showed higher Specific Cooling Capacity (SCC), compared to activated carbon (AC)/methanol pair. Experiments done with blocks with different proportion of EG, showed that the proportion of EG influence the cooling capacity per unit mass of salt and had almost no influence on the cooling capacity per unit mass of the block. Moreover, the reaction enthalpy (ΔH) and entropy (ΔS) were calculated from experimental data obtained experimentally, and confirmed previous reported values.

Keywords

- Solar energy;
- Adsorption;
- Ice maker;
- Lithium chloride;
- Expanded graphite