A consolidated composite sorbent made from manganese chloride and expanded graphite was produced for sorption deep-freezing processes and used for cold production at a temperature as low as −35 °C. Experimental results showed that the addition of a porous graphite matrix can prevent the agglomeration and the attenuation of sorption capacity of reactive salt. The composite sorbent could incorporate 0.537 kg of ammonia per kg of reactive salt and the average specific cooling power (SCP) obtained varied between 200 W kg−1 and 700 W kg−1 when the evaporation temperature ranged from −35 °C to 0 °C. The analysis of the data suggested that the heat transfer characteristic in the composite sorbent was strongly influenced by chemical reaction and the conversion rate was very sensitive to the constraint temperatures. The SCP and coefficient of performance (COP) of a simple sorption deep-freezing system were 350 W kg−1 and 0.34, respectively, at the generation temperature of 180 °C, the heat sink temperature of 25 °C and the evaporation temperature of −30 °C.