

Impact of Refrigerant Flowing Resistance to Adsorption Refrigeration Cycle

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ABSTRACT

In adsorption refrigeration system, the adsorber fulfilled with adsorbent is served as a compressor in cycle, adsorbing low-pressure gas from evaporator, desorbing and pumping high-pressure gas into condenser. The ideal adsorption refrigeration cycle could be described as figure1, in which, the right(1-2-3-4-1) represents the adsorbent cycle, and the left(1-2-5-6-1) represents the refrigerant cycle, desorption pressure P_{de} is equal to condensing pressure P_c , and adsorption pressure P_{ad} is equal to evaporating pressure P_e . However, in actual machine, there are unavoidable pressure losses in the route of refrigerant. As shown in figure 2, the P_c is lower than P_{de} , and P_{ad} is lower than P_e . In principle, the gas pressure of refrigerant determines directly its adsorption or desorption processes on adsorbent. Moreover, some of working pairs, such as zeolite –water, activated carbon –methanol, work in vacuum environment in adsorption refrigeration system, and do not permit great flowing resistance. Therefore, it is necessary to uncover the impact of flowing resistance to adsorption refrigeration.

This paper shows a simple model considering the gas resistances among adsorbers, condenser and evaporator. Through numerical simulation and experimental verification, the effect of flowing resistance is analyzed. The involved performance in activated carbon- ammonia system is also compared with in activated- methanol system. According to results from this paper, the suction line heat exchanger should be checked the flowing resistance carefully before being applied to recover heat from evaporated gas. The analysis and results could be provided as references in designing a system of adsorption refrigeration.

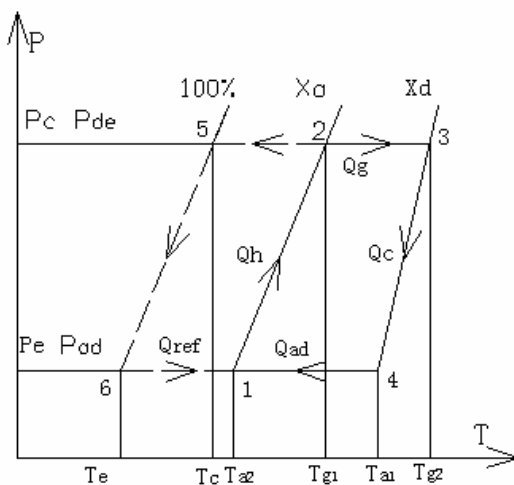


Figure 1 Ideal adsorption refrigeration cycle

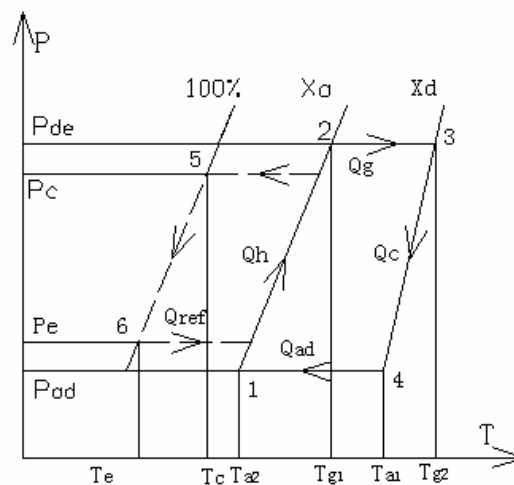


Figure 2 Actual cycle of adsorption refrigeration considering the flowing resistance