

ADSORPTION REFRIGERATION WITH PHASE TRANSITIONS OF WORKING FLUID IN SORBENT AT MINIMAL TRANSPORT RESTRICTIONS: 1D-MODEL

Liakh M. Yu., Rabinovich O. S.

A. V. Luikov Heat and Mass Transfer Institute, NAS of Belarus
15 P.Brovka St., Minsk, 220072, Belarus
E-mail: liakhmaria@gmail.com

Abstract

The limiting case of uniform distribution of heat transfer fluid over the cross-section of adsorbers of an adsorption refrigerator is considered. The heat transfer between the fluid and the sorbent is close to ideal. In this case, the characteristics of refrigeration attain their maximal values. The appropriate model of the refrigeration that includes new sub-models of composite sorbents and phase transitions of working fluid in pores of low-temperature sorbents is developed. The mathematical model is conceptually one-dimensional and allows thorough investigation of effects of various parameters and optimization of refrigeration process. The advantage of reverse heat-transfer fluid flow in the low-temperature adsorber at a low-pressure stage of refrigeration is demonstrated. It is shown by similarity analysis that the most important parameter of the process is the ratio of the adsorber length to the flux of heat-transfer fluid. The second parameter, the volume fraction of heat-transfer fluid, plays a minor role. Basing on this result, for the given sorbents and heat reservoirs temperatures, the universal dependence of specific cooling production on the mean cooling-temperature drop was found.