ANALYSIS OF THE ADSORPTION PHASE PROCESSES

Pogorelova Natalia Dmitrievna, Draganov B.Kh., Demchenko V.G.
Institute of Technical Thermophysics of the National Academy of Sciences of Ukraine, Kiev, Ukraine
tel. (044) 4532868, e-mail: vptt@i.ua

Goal of the work – Development of a method for studying the processes of heat and mass transfer in multicomponent media at phase transitions by the method of non-equilibrium linear thermodynamics.

Results – Numerical modeling of adsorption methods in phase processes is a very urgent task for the theoretical development of thermodynamics. In addition to the scientific aspect, the analysis of adsorption in phase processes is of great practical interest in various industries and the environment. There are quite a few important issues arising during the construction of the thermodynamic model due to the lack of reliable equations describing the processes of heat and mass transfer in multicomponent media.

In the thermodynamic analysis of sorption systems, adsorption in the surface layer (macro porous sorbents) and microspores (micro porous sorbents) are usually distinguished. In the properties of the sorption phases of both types there is a profound analogy. Therefore, in both cases, the fundamental equations must contain the term σdW, which takes into account the additional work of the formation of the surface layer (σ is the surface tension or the internal pressure of the macrospores, W is the surface area or volume of the absorption phase). The analysis of transitions is based on the Gibbs provisions. The basic information about the principles of the method of phenomenological relations based on the provisions of non-equilibrium thermodynamics is analyzed. In particular, attention is paid to the analysis of phase transitions from the position of non-equilibrium thermodynamics. The applied Onsager's relations, which showed that non-equilibrium thermodynamics, as well as equilibrium, leads to general results that do not depend on the choice of a particular molecular model. The process of heat and mass transfer of multicomponent media and conditions of entropy production in the analyzed processes is researched.

Conclusions

1. Analysis of phase transitions, including adsorption phenomena, should be performed by methods of non-equilibrium thermodynamics.

2. The derivation of generalized relations on the basis of the phenomenological relations of Onsager allows us to obtain important algebraic relations, the solution of which is not complicated. These solutions are valid for a wide range of environments, for example, multicomponent gas mixtures.

3. The characteristic of the irreversibility of non-equilibrium environments is the production of entropy.