High Pressure Physics and Engineering, Vol. 23, № 4

S.V. Terekhov, I.K. Loktionov

UNIVERSALITY OF SYNERGETICS LAWS. III. EXTENSIVE THERMODYNAMICS AND KINETICS OF THE PROCESSES

Small deviation of the macroscopic system from thermodynamics equilibrium is accompanied by appearance of spatial periodicity. Every emerged microscopic area is located in the state of local thermodynamics equilibrium, or evolves in vicinity. The last case requires to distinguish extensive and non-extensive areas.

There are small gradients of extensive parameters in the areas of the first type. These parameters are selected as independent arguments at description of behavior of the system in the thermodynamics space. The areas of the second type are formed by small gradients of intensive descriptions (thermodynamics potentials). In this case, internal thermodynamics forces form two levels limiting possible oscillation of the system.

Thus, non-equilibrium arises up both as a result of changed position of the system in the thermodynamics space of extensive parameters and due to the change of the field potentials originating internal thermodynamics forces. Therefore realization of the detailed analysis is expedient within the framework of extensive thermodynamics of the fields of different characteristics of the system and processes of self-organizations at small deviation of the system from equilibrium.

The existing models of the non-equilibrium phenomena and processes have a number of defects. For example, classification of steady-states of the system at a small deviation from position of thermodynamics equilibrium have not been conducted and the role of kinetic streams has not been found out. The theory of quaternions of Hamilton and vector algebra of Gibbs was therefore applied. They allowed not only to classify local areas but also to get a number of new results:

– substantiation of Onsager model application;

– generalization of Helmholtz theorem about the presentation of any vector as a sum of potential and solenoid fields;

– evolutional equation for the stream of an extensive parameter;

– system of the constrained equalizations, one of consequences of which is possibility of existence of hierarchy of processes, et al.

In addition, the offered model allows setting distinctive signs and distinguishing the different steady-states of the thermodynamics system. The transition of the system from one steady-state to another is accompanied by the change of structure of the macroscopic system.

The obtained correlations are of universal character and do not depend on the physical nature of the thermodynamics system. Universality is a consequence of scale invariance, i.e. it represents fractal nature of the physical level of existence of matter.

Keywords: thermodynamics force, stream, extensiveness, steady-state, self-organization