HYDROMECHANICS OF MULTICOMPONENT MULTIPHASE COMPRESSIBLE MEDIA

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Dynamic effects on muticomponent media take them out of equilibrium state and lead to relaxation processes when components interact and interchange by momentum, energy and mass if chemical reactions take place. Usually the well-known models consider the interchange processes in the frames of pair component interactions taking into account their special features (particle size, surface purity, adhesion properties, etc.). The work proves that the wide-used expression for intensity of momentum interchange between components violates the invariance of energy equation respecting to the Galilean transformation. In this place a tensor of strains external for i^{th} component is proposed and its dependence on component velocities is determined. A multicomponent medium is considered as a continuum medium with averaged values and a new type of the mixture effect on each component so called cluster interaction is proposed. The conditions are studied when averaged values P, ρ, E, $\overline{U}$ satisfy the system of conservation laws as well as how these conservation laws correspond to the component conservation laws. Not only new forces F_{si} occur in the process of cluster interaction between i^{th} component and mixture but energy fluxes $\overline{Q}_{si}$ acting on each component with a velocity not equal to an equilibrium one. The force F_s and the energy flux $\overline{Q}_s$ acting on the continuum medium are connected with F_{si} and $\overline{Q}_{si}$ by the equations

$$F_s = -\sum_{i=1}^{N} \alpha_i F_{si}, \quad \overline{Q}_s = -\sum_{i=1}^{N} \alpha_i \overline{Q}_{si} .$$

To eliminate the violence in F_s, $\overline{Q}_s$, F_{si}, $\overline{Q}_{si}$ determination they supposed to be invariant to the Galilean transformation. It is shown that after introducing new forces and fluxes the system of mixture conservation laws is obtained as a sum of component conservation laws. A conception of component non-equilibrium kinetic energy is introduced and additional equation for volume fractions is proposed which closes the system of conservation laws and the equation of state of i^{th} component and does not restrict the mixture properties.

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