COUPLING MODEL OF THE COMBUSTION SYNTHESIS OF COMPOSITE WITH REINFORCING INCLUSIONS[1]

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The stress-strain state plays a important role in the synthesis of new materials. The phenomenon of a change inthe rate and staging of phase formation with a change in the stress-strain state is known and is used to control the process. However, the features of phase formation during the synthesis of composites in different states are poorly studied. In this paper, for the first time, a coupled mathematical model is formulated (taking into account the interrelation between the processes of different physical nature - thermal, chemical and mechanical), taking into account the staged nature of the transformation for systems of the type Al + Cr2O3 + Ti; Al + Fe2O3 + Ni for conditions of plane stress and plane strain state. The first situation is realized during the synthesis of a composite in a layer on a thin substrate, which takes heat from the reaction zone. The second situation can be realized during the reaction in a mixture of reagents in the gap between inert materials that prevent deformation in the direction perpendicular to the direction of reaction propagation of the front. In the framework of the thermodynamics of irreversible processes, relations for the chemical affinity of the main reactions are established, taking into account the presence of stress-strain state. For some limiting cases, a traveling wave type solution is constructed using the method of joint asymptotic expansions. The stability of the reaction front to thermomechanical disturbances was studied taking into account heat losses.

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