STRESSES STIPULATED BY REACTIVE-DIFFUSION IN LOCAL VOLUMES DURING SINTERING OF POWDER MIXTURE Ti-Al-Fe-Fe_2O_3*

M.A. ANISIMOVA [1,2], A.G. KNYAZEVA [1,2], E.N. KOROSTELEVA [1,2], I.O. NIKOLAEV [1]

[1] Institute of Strength Physics and Materials Science SB RAS, Tomsk, Russia
[2] Tomsk Polytechnic University, Tomsk, Russi

In the modern world, the issue of utilization of recycling waste is acute. The most urgent task is to use metalworking waste as a raw material for obtaining new materials. A large share of waste from the processing industry is metalworking waste of steel billets. The remaining metal chips can be used as one of the components of powder material for obtaining composites in sintering technology. The use of crushed metal chips in mixtures based on titanium with the addition of aluminum is very attractive and can lead to the synthesis of hardening phase directly during reaction sintering, which is the subject of this study.

Phase formation during sintering in multicomponent powder systems depends largely on the mutual arrangement of powders of different types, their shape, surface properties, temperature, etc. [1]. Depending on the percentage of components, the homogeneity of mixing and the nature of heating, different sequences of reactions and related phenomena can be distinguished, which can lead to different phase compositions. All situations of meeting and interaction of particles with each other described in [1-5] are reduced to models of reaction diffusion in plane, cylindrical or spherical coordinate systems. These are problems with moving interfaces, the number of which can be different depending on component pairs and temperature. However, the change of composition due to diffusion and the appearance of new phases is always accompanied by stresses and deformations, which, in turn, can influence the phase formation.

In the present work for different particular situations the estimation of mechanical stresses is carried out using the obtained analytical solutions of reaction diffusion problems and mechanical equilibrium problems in which time is a parameter. As a result, it is possible to analyze the evolution of stresses and deformations depending on the position of interfaces between phases and the distribution of concentrations in the phases, similarly to [6,7] It is found that stresses in the vicinity of interfaces are very high and depend significantly on diffusion-kinetic parameters. In some situations it is possible to construct approximate solutions of fully coupled problems taking into account the influence of stresses on diffusion.

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* The work was supported by the Russian Science Foundation and the Tomsk Region Administration under grant No. 22-13-20031, https://rscf.ru/project/22-13-20031/.