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CALCULATIONS OF SINTERING OF POWDER COMPOSITES[1]

[1]Burago N.G., [2]Nikitin I.S.
[1] Institute for Problems in Mechanics of RAS, Moscow, 119526, Russia
[2] Institute for Computer Aided Design of RAS, Moscow, 123056, Russia

The paper presents the results of the calculation of the process of sintering of powder composites based on a modified theory of elastic-plastic flow [1]. Along with temperature, and full of plastic deformations in the number of state parameters introduced porosity and damage. The kinetic equations for porosity and damage are derived from the laws of thermodynamics for continuous media. In the modified theory the Lame elastic parameters, the yield stress and strength limits depend on the porosity and damage. The sintering process provides the creation of solid deformable bodies from a mixture of metal powders. This process takes place due to volumetric compressive stress of non-thermo-nechanical nature, so called sintering stress, providing the effect of capillary forces acting on the surface of micropores in the molten matrix composite on to solid particles of hard-melting composite component. The creation of solid samples from powder composites samples is performed taking into account the contact interaction between composite “green body” and the walls of the mold during cold pressing and hot sintering stages. Some special processes of sintering are calculated in order to prolong the safety life of aircraft structures. The safety life prolongation is reached due to hardening of the surface layers of aircraft parts using layer–by-layer sintering of powder composites by action of movable laser with high energy radiation in industrial devices of 3D printing. Account of damage in our model is used to detect undesired development of sintering processes, accompanied by damage of sintered products.

References

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