Advances in Discrete Elements Modeling of Porous NiAl Materials

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ABSTRACT

The object of this paper deals with suggestion of an approach, which could be used for modelling of porous newly designed and manufactured using spark plasma sintering intermetallic nickel aluminide (NiAl) materials [1].

Discrete element method (DEM) [2], as one of the most relevant methods used in materials modelling, has been adopted for behaviour of above mentioned materials modelling. It should be noted that using DEM the main chalanges are to have initial set of discrete elements. In this analysis it is obtained using concepts of initial/uncracked representative volume element (RVE) and micro computer tomography (CT). The elaborated discrete model assumes the porous material as a particulate domain composed by the finite number of bonded solid particles. The bonded particle model based on parallel bond [3] is employed for the damage simulations. It transmits both the force and the moment between the bonded particles. The parallel bonds break instantaneously when the maximum tensile stress exceeds the tensile strength or the maximum shear stress exceeds the shear strength of material.

Quasi static analysis of uniaxial compression test specimen is performed. Time consuming computations of approximately million bonded particles are performed by using OpenCL-based DEM software [4] on NVIDIA® Tesla™ GPU. Results obtained are compared with experimental data and are in quite good agreement in elastic engineering stress-strain response regime, while main cracks are not investigated.

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