Development of a multiscale model of powder sintering

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Abstract:
Sintering is an essential stage of powder metallurgy processes in which solid parts are manufactured from metal or ceramic powder mixtures. Sintering consists in consolidation of loose or weakly bonded powders at elevated temperatures, close to the melting temperature with or without additional pressure. Sintering is a complex process affected by many factors and modeling can be used to optimize and to understand better the process. There are different approaches in modeling of sintering processes, ranging from continuum phenomenological models to micromechanical and atomistic ones.

An ongoing research work on the development of a multiscale model of powder sintering will be presented. The theoretical formulation will include models at atomistic, microscopic and macroscopic scales. The presentation will be focused on the micromechanical model and micro-macro scale transfer. The micromechanical model of sintering has been developed in the framework of the discrete element method [1]. The micro-macro relationships can be derived from the discrete element simulations of powder sintering [2]. The presentation will be illustrated with numerical results. The numerical simulations have been performed for sintering of the NiAl powder. The numerical model has been calibrated using own experimental results.

References

[1] S. Nosewicz, J. Rojek, K. Pietrzak, M. Chmielewski, Viscoelastic discrete element model of powder sintering. *Powder Technology,* **246***,* 157-168, 2013.
[2] J. Rojek, S. Nosewicz, K. Pietrzak, M. Chmielewski, Evaluation of macroscopic stresses in discrete element models of sintering processes, Computer Methods in Materials Science, **15**, 219-225, 2015.

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