# Particle-Based Methods III

## Fundamentals and Applications

### 18-20 September 2013, Stuttgart, Germany

M. Bischoff, E. Ramm, E. Oñate, R. Owen and P. Wriggers (Eds.)

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# Discrete element modelling of powder metallurgy processes

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## ABSTRACT

Powder metallurgy is a method of manufacturing of net-shape components from metal or ceramic powder mixtures. As a technological process, powder metallurgy consists of several stages including metal and ceramic powder manufacturing, preparation of metal-ceramic powder mixture, powder pressing and sintering. Sintering consists in consolidation of loose or weakly bonded powders at elevated temperatures, close to the melting temperature with or without additional pressure. Powder metallurgy is a complex process affected by many factors. Modelling can be used to optimize and to understand better the process.

The paper will present an original thermo-viscoelastic discrete element model of powder metallurgy process allowing us to simulate powder compaction, heating, sintering and cooling. The discrete element formulation used in the model employs spherical particles representing powder grains. The model has been implemented in the discrete element program DEMPack [1]. The cohesive contact interaction model [2] takes into account sintering driving force which attracts powder grains and viscous resistance.

The model will be applied to study sintering of intermetallic powder NiAl and intermetallic-ceramic NiAl-$Al_2O_3$ composite. Experimental studies have been performed to calibrate and validate the model. Numerical results confirm a good performance of the model and its capability to reproduce microscopic and macroscopic phenomena occurring during a powder metallurgy process.

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