Multiscale modelling of powder sintering processes

Jerzy Rojek*, Szymon Nosewicz, Marcin Maździarz, Piotr Kowalczyk, Krzysztof Wawrzyk

Institute of Fundamental Technological Research, Polish Academy of Sciences
Pawinskiego 5B, 02-106 Warsaw, Poland
Email: jrojek@ippt.pan.pl, web page: http://www.ippt.pan.pl

ABSTRACT

A framework for a multiscale model of powder sintering processes will be presented. Sintering is a technique of powder metallurgy consisting in consolidation of loose or loosely bonded ceramic or metal powders at elevated temperature with or without pressure. During sintering particulate material is converted into compact solid material. At sintering, processes at different levels interact with one another, therefore in numerical modelling we should consider physical phenomena occurring at various scales.

The multiscale model presented includes numerical models for three scales relevant for sintering: atomistic, microscopic and macroscopic one. The atomistic modelling has been carried out using the molecular dynamics [1], the microscopic model has been developed within the discrete element method [2], and the finite element method has been a modelling framework for the macroscopic model.

Theoretical formulations of the numerical models and their implementation will be presented. Modelling at lower scales will provide parametric information to the upper scale while the upper scale models provide boundary conditions for lower scale analysis. The numerical model will be validated using the results of own experimental studies sintering of NiAl powder.

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