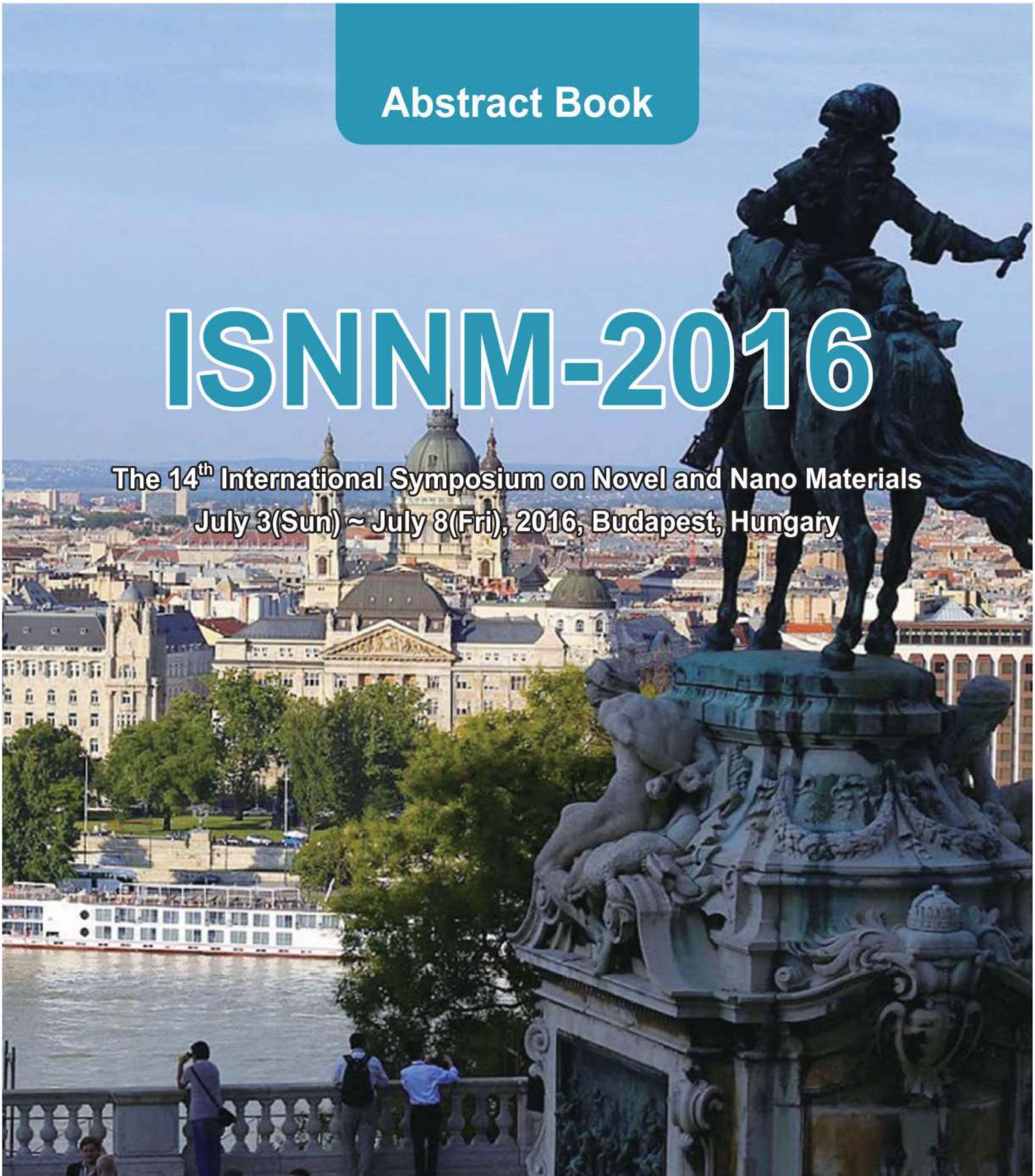
Abstract Book



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Application of contact interaction of Hertz model to viscoelastic discrete element model of sintering

S. Nosewicz[1*], K. Jurczak[1], J. Rojek[1], M. Chmielewski[2] and K. Pietrzak[1,2]

[1] Institute of Fundamental Technological Research Polish Academy of Sciences, Warsaw, Poland
[2] Institute of Electronic Materials Technology, Warsaw, Poland
*snosew@ippt.pan.pl

ABSTRACT

The discrete element method (DEM) is a relatively new numerical method based on the discrete model of material. In DEM, a material is represented by a large assembly of particles interacting among one another with contact forces. A particle interaction model in the DEM can take into account different effects, which are related to the specific model application. The formulation of appropriate contact interaction of particles seems to be an essential requirement to model properly the material behavior in the macroscopic scale.

Currently, DEM is a widely acceptable method and has become a popular and useful tool for modeling discrete systems, such as a powder particles interactions in the powder metallurgy processes. Sintering is the most important stage of powder metallurgy processes consisting in consolidation of loose or weakly bonded powders at elevated temperatures, close to the melting temperature. Modelling of powder metallurgy and sintering processes requires a special constitutive model for particle contact interaction in which the sintering driving forces, viscosity, elasticity, cohesive and thermal interactions play a significant role. Although deformation during sintering itself is governed mainly by the viscosity, the material does maintain certain elasticity [1,2]. Elastic effects may influence the distribution of forces in the heterogeneous particulate material and have some importance to the evaluation of stresses during sintering and subsequent cooling.

This paper presents the numerical modelling of pressure-assisted sintering performed by original viscoelastic discrete element model [3]. In the following work two elastic contact interaction models – linear and nonlinear Hertz model - has been implemented and analyzed in the field of rearrangement and interaction of powder particles during compaction and sintering process. Results of macroscopic effects, such as shrinkage and material densification, have been compared. Numerical models have been calibrated and validated using own experimental results. Although it has been shown that the both models properly represent macroscopic behavior of the material at the sintering process, the Hertz model seems to produce the results closed to the real experimental ones.

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KEYWORDS

powder metallurgy, sintering, discrete element method, Hertz model, numerical simulation

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