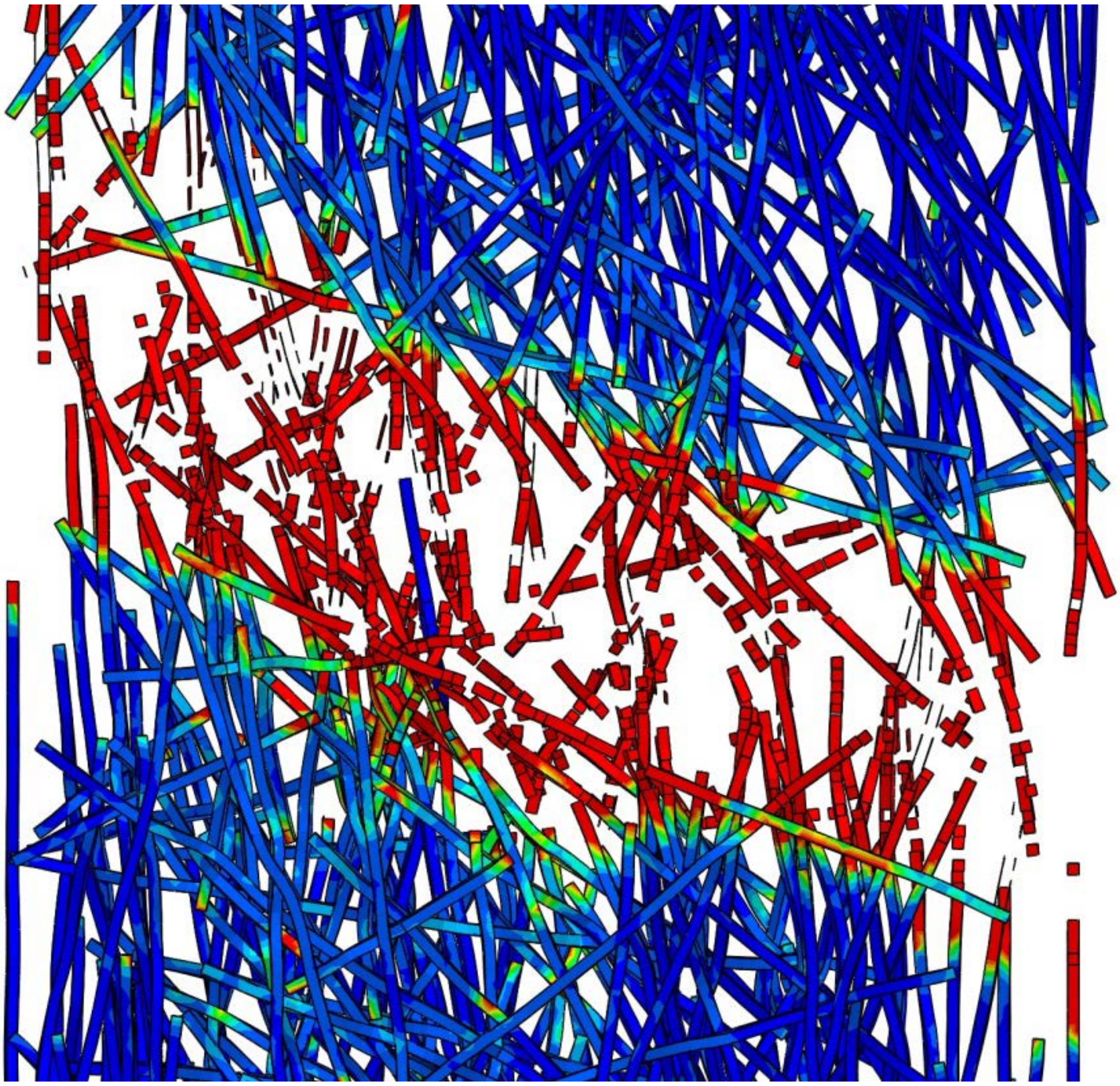
8th KMM-VIN Industrial Workshop

Modeling of Composite Materials and Composite Coatings

October 09-10, 2018
Freiburg, Germany

Programme and Abstracts



European Virtual Institute on Knowledge-Based Multifunctional Materials KMM-VIN AISBL
Fraunhofer-Institut für Werkstoffmechanik IWM

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Organized by

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Fraunhofer-Institut für Werkstoffmechanik IWM

Hosted by

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The **European Virtual Institute on Knowledge-based Multifunctional Materials KMM-VIN AISBL** is a self-sustainable non-profit organization which promotes and facilitates cooperative research and development activities of its Members in advanced structural and functional materials. It creates conditions for networking and conducting joint research on advanced materials and offers a mobility program for young researchers and customized courses and trainings with focus on materials for Transport, Energy and Biomedical sectors.

The **Fraunhofer Institute for Mechanics of Materials IWM** is a research and development partner for industry and public contracting bodies concerning the topics of component and systems reliability, safety, durability and functionality. The Fraunhofer IWM's »mechanics of materials« approach is used to identify weaknesses and defects in materials and components, determine their causes and develop solutions that lead to the safer use of components as well as the development of functional materials and resource efficient manufacturing processes.

Multiscale modeling of sintering process of mixture of two-phase powder

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Sintering is a manufacturing process in which loose or weakly bonded metal or ceramic powders are consolidated into a solid compact body by heat treatment which can be combined with mechanical pressure. Macroscopically during sintering, one can observe changes of the bulk material volume (shrinkage) and, associated with this, densification and decrease of porosity. The microstructure during sintering undergoes an evolution characterized by grain rearrangement, increase of grain compaction and formation of cohesive bonds between powder particles which occurs due to mass transport. Surface and grain boundary diffusion are normally dominant mechanisms of mass transport in sintering.

This work presents a three-scale framework for numerical modelling of sintering phenomena of two-phase mixture. The proposed approach bridges simulations performed at the atomistic, microscopic and macroscopic scales. The atomistic modelling has been carried out using the molecular dynamics (MD) to determine the diffusive parameters, which define material behavior during sintering and are used in the microscopic model of sintering. The authors' own original viscoelastic model [1] developed within the framework of the discrete element model have been used for simulation of the powder sintering process at the microscopic level. The macroscopic constitutive model is based on the assumption that the sintered material is a continuous medium. The parameters of the constitutive model are determined by simulation of sintering at the microscopic level. The model has been validated using the results of own experimental studies of pressure-sintering of $NiAl/Al_2O_3$ powder.

[1] S. Nosewicz, J. Rojek, K. Pietrzak, and M. Chmielewski (2013). Viscoelastic discrete element model of powder sintering, Powder Technology, 246, 157–168.

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