Contribution ID: **62** Type: **2. Invited speaker (by invitation only)**

Coupled Diffusion, Grain Motion, and Stress in Sintering: A Phase-Field–Micromechanics Approach

Sintering is a key processing route for ceramics and metals, where densification and microstructure evolution are governed by coupled diffusion, grain motion, and stress development across multiple length scales. In this work, we present a thermodynamically consistent phase-field–micromechanics model (PFMMS) that rigorously couples mass transport, grain boundary migration, and mechanical deformation within a unified energy framework. Unlike conventional approaches where grain motion is introduced phenomenologically, the driving force for grain motion in the proposed model is derived variationally from the total free energy, ensuring strict compliance with the second law of thermodynamics. The governing equations are obtained from a unified energy dissipation principle, eliminating spurious non-densifying mechanisms and guaranteeing monotonic energy reduction. Benchmark simulations demonstrate that the model accurately captures intrinsic stress distributions, grain-motion-induced densification, and system-size-independent shrinkage while preserving equilibrium states. The framework provides a physically sound and computationally robust basis for multiscale modeling of sintering processes, with direct relevance to the design and optimization of advanced ceramic and metallic components.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

Journal of the European Ceramic Society (Elsevier)

Invitation letter for visa

Yes

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Session Classification: Modelling and simulation of sintering at multiple scales

Track Classification: Group 1: Modelling and simulation of sintering at multiple scales