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Development of a phase-field sintering model for highly accurate prediction of sintered microstructure and defects

Since the properties of sintered products are significantly affected by their microstructures and defects formed during the sintering process, accurate prediction and control of the microstructure evolution are essential. However, experimentally observing the sintering process in situ is not straightforward. Therefore, numerical simulation studies for predicting microstructural evolution are crucial. The phase-field (PF) method is the most accurate numerical approach that reproduces the material microstructure. Nevertheless, existing phase-field sintering models have challenges in reproducing densification behavior caused by particle rigid-body motion, especially in multi-particle systems. As a result, they are unable to accurately reproduce the formation of defects and cracks during sintering. In this study, we develop a rigid-body motion model based on beam elements. In this model, grain boundaries are represented by beam elements, whose two ends are connected to the centers of mass of particles via rigid offsets. This model enables high-accuracy reproduction of shrinkage, separation, and sliding between particles, and allows accurate simulation of microstructural evolution and defects during sintering. Using this model, we performed simulations and verified the validity and effectiveness of the developed model.

Professional Status of the Speaker

Doctoral or Master Student

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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