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Numerical Evaluation of Nonuniform Sintering Shrinkage and Residual Stress in Bulk Ceramics Induced by Internal Temperature Gradients

This study presents a numerical evaluation of deformation and stress in bulk ceramic bodies induced by internal temperature gradients during the sintering process. Finite element simulations are conducted using a model previously proposed by the authors, in which the total deformation is decomposed into four components: thermal-reversible, thermal-irreversible, mechanical-reversible, and mechanical-irreversible. Large deformation theory is employed to account for the significant sintering shrinkage of approximately 20 %, and Master Sintering Curve is adopted to describe the thermal-irreversible deformation behavior. The model is implemented into the commercial finite element software ANSYS via User Programmable Features (UPFs). Several numerical examples are presented to investigate deformation behavior and the development of stress during sintering. Particular attention is paid to the influence of internal temperature gradients on stress formation. The simulation results provide insight into the mechanisms of stress generation during sintering and are expected to contribute to a better understanding of macroscopic sintering behavior in bulk ceramics.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

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Invitation letter for visa

No

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