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Sintering properties evaluation of metal powder compacts considering machine learning-based grain growth model

The sintering shrinkage of ceramic powder compacts is large because the organic binder is mixed in forming process, whereas metal powder compacts also experience large sintering shrinkage when formed using metal injection molding or sinter-based additive manufacturing technologies. To analyze the shrinkage deformation of powder compacts in the sintering process, material parameters in a constitutive equation, such as viscosity coefficient, sintering stress, and viscous Poisson's ratio should be obtained in experiments. In this study, we evaluate the sintering properties of pure nickel powder compacts, as a model material, using an atmosphere-controlled sinter-compression testing machine. At the same time, we measure the crystal grain size in the compact, which affects the viscosity coefficient, for each test, and use a machine learning to model the grain growth behavior as a function of the heating history and relative density. Using the machine learning-based model for crystal grain size, we identify the viscosity coefficient purely as a function of relative density, and examine its validity by comparing it with the existing constitutive models for sintering.

Professional Status of the Speaker

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No

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