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A mesoscale simulation model of solid state sintering applied to X2CrNiMo17-12-2 stainless steel

Solid state sintering is governed by self-diffusion processes that induce the formation and growth of sinter necks. This may be accompanied with the successive approach of individual particles to each other that manifests in a macroscopic shrinkage and distortion. In this context, numerous studies contributed to a profound understanding of the interdependence between powder particle size distribution, relative density, temperature, the hereby induced changes of pore morphology and dimensional changes for various materials. This knowledge has been aggregated in different numerical models on both the macro- and the mesoscale. While macroscopic models largely rely on experimentally gathered phenomenological data, mesoscopic models offer the potential to incorporate physical material properties instead. Hence, a level-set model was developed that describes a two-dimensional microstructure as a signed distance function. Individual diffusion mechanisms are modelled based on physical descriptions of the velocity with which the pore surfaces evolve, while accounting for local surface curvature and the stress state underneath the surface. Simultaneously, mesoscopic shrinkage is modelled postulating mass constancy in the sinter neck. The applicability of the model is demonstrated by simulating sintering of X2CrNiMo17-12-2 processed by metal injection molding. Good agreement between experimental and numerical results is shown with regard to microstructural and dimensional changes.

Professional Status of the Speaker

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Interest in submitting a paper in a special issue of

No interest

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