Sintering Assisted Additive Manufacturing

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Additive manufacturing is increasingly used to make porous preforms followed by sintering to fabricate the final component. The effects of fabrication directionality and gravity on micro- and macro-structure of sintered components are still poorly understood. Present technologies of additive manufacturing (such as binder-jetting, stereolithography, robocasting, selective laser sintering, etc.) of complex-shape powder-components necessitate fine-tuning of sintering as applied to porous 3D-printing products. The densification of complex shapes requires control of the gravity-related and anisotropy phenomena to ensure a nearly full and distortion-free densification. The conducted studies address these issues through the involvement of comprehensive finite element simulations, the determination of the additively manufactured powder specimens' sintering behavior, and the experimental validation of the developed models describing sintering of 3D-printed objects. The presentation describes the numerical modeling of macro and micro- defect formation during sintering of 3D-printed powder components. The validation of the developed models is conducted through the comparison with the experimental results obtained for the sintering of the printed powder ceramic and metallic components. An analytical engineering criterion, which can be used for sintered 3D-printed parts' design recommendations, is derived