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Modeling sintering of granulated WC-12Co powder manufactured by Metal Binder Jetting

The Metal Binder Jetting technology (MBJ) is a sinter-based additive manufacturing process gaining increasing interests due to its benefits to quickly produce complex parts for small to medium series. Despite its attractiveness, MBJ still faces many challenges at every stage of the process, such as low green part strengths, repeatability issues and precise control of dimensional accuracy after sintering. The latter is hindered by several aspects. First, the green part relative density is low in MBJ, leading to significant volumetric change during sintering to full density. Second, the layer-by-layer process leads to anisotropic shrinkage. Third, complex parts being targeted, those are often prone to sagging because of creep at high temperature.
In this work, cemented carbides (WC-12Co) were granulated, printed using MBJ and then sintered to reach full density (from ~35% to >98% relative density). Though the main densification mechanism was liquid phase sintering, the Skorohod-Olevsky Viscous Sintering model was used to predict sintering-induced deformation. To that end, material parameters were first identified using dilatometry experiments on MBJ printed parts. Then, the model was modified to account for anisotropy in the building direction and implemented in the code Mfront, for subsequent use in a finite element solver. Finally, calibration parts were used to fine tune the constitutive parameters so that to model shrinkage and creep with less than 5% of deviation.

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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