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Sinter-based Additive Manufacturing of Carbide-Rich Tool Steels AISI A11 and AISI M3

Metal Binder Jetting (MBJ) combined with sintering enables Additive Manufacturing (AM) of carbide rich steels that are standard in tooling but are prone to cracking in beam based AM.

For high-speed steel HS6 5 3 (1.3344, AISI M3) and cold-work steel X245VCrMo10 5 1 (AISI A11) we developed printing, debinding and sintering parameters to yield crack free, low distortion parts. We map the sintering window with respect to debinding quality, heating rate, sintering temperature, dwell, and atmosphere, and show how these parameters govern densification, shrinkage anisotropy, and microstructure. We present strategies to mitigate distortion and investigate how variations introduced during printing affect the final properties. Repeatable debinding and sintering cycles across multiple builds and powder lots result in near full densification and predictable linear shrinkage, despite the relatively low green density of MBJ parts. By testing a large number of samples and different geometries, we obtained statistically robust results that can be transferred to demonstrator-scale geometries.

The talk will report mechanical properties achieved for AISI A11; investigations for HSS (AISI M3) are ongoing. The results provide actionable guidelines for MBJ tool steel sintering, a foundation for systematic property benchmarking against conventional, PM HIP, and PBF LB routes, and pave the way to industrialization.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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