Additive Manufacturing of Steels for Tooling Applications

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ABSTRACT

High carbon tool steels are commonly used for tool holders, tabs and dies, etc. for their favorable combination of toughness with satisfactory hardness, wear resistance, and high temperature strength. Additive manufacturing allows for the geometrical degree of freedom, and it has become an attractive option to fabricate tools with complex shapes and intricate cooling channels. However, carbon tool steels made using laser powder bed fusion are susceptible to cracking due to the martensitic transformation and thermal stresses. Maraging steels, on the other hand, also feature high hardness and strength but are much easier to print due to low carbon content, so they can also be used for some tooling applications. This work will discuss the challenges and solutions in printing tool steels and maraging steels and compare microstructure and properties between them. This work will also show examples of innovative components enabled by using DFAM principles.