

MM 1: Invited Talk Carolin Körner

Time: Monday 9:30–10:00

Location: H44

Invited Talk

MM 1.1 Mon 9:30 H44

A novel mechanism to generate metallic single crystals

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Single crystals are used for high strength materials with high creep resistance such as turbine blades from nickel-base superalloys. The fabrication techniques applied to produce single crystals involve highly controlled and therefore relatively slow crystallization. For turbine blades, the Bridgman technique, i.e. investment casting combined with directional solidification, is the standard. The single crystal either develops starting from a single crystalline seed or by a geometric grain selection process. Microstructure evolution is determined by the solidification

conditions resulting in a dendrite arm spacing of several hundreds of microns. This contribution shows how single crystals from nickel-base superalloys develop without seed during layer by layer metal additive manufacturing (AM) in the powder bed. These AM single crystals develop under rapid and directional solidification conditions with solidification microstructures one or two orders of magnitude finer than in the conventional Bridgman process. In addition, the underlying mechanism to generate the single crystal is based on thermo-mechanical provoked texture formation. The latter allows a very precise orientation of the single crystal. A manipulation of the orientation is possible by applying adequate process strategies. The basis mechanisms leading to the single crystal and the implications on the resulting properties are discussed.