Texture and texture mitigation in the dual phase hypo-eutectic alloy Al0.75CrFeNi2.1 manufactured by laser powder bed fusion

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Abstract

The dual phase hypo-eutectic medium entropy alloy Al0.75CrFeNi2.1 was processed by laser powder bed fusion (LPBF). The strongly out-of-equilibrium solidification conditions induce a directional growth of the primary FCC phase with a cellular morphology and the BCC phase appears as a thin intercellular envelope. Growth undercooling and the associated characteristics of the cellular mushy zone prohibit eutectic coupled growth. The as-built microstructure is metastable, with a lower fraction of BCC than in equilibrium. Post-build annealing finally enables growth of BCC in solid state, which results in the formation of a novel quasi-lamellar pattern between FCC and BCC. The lamellar alignment is attributed to phase boundary anisotropy. Expectedly, the solid state transformation does not remove the initial texture inherited from LPBF, but leads to an overall texture mitigation along with the BCC formation even in the presence of crystal orientation relationship(s). We aimed at investigating the texture evolution and overall texture mitigation *in-situ* during continuous heating of an as-built sample up to 1200∘C using high-energy synchrotron X-ray diffraction at the Deutsches Elektronen-Synchrotron DESY. We will present and discuss these experimental results.

Keywords: Additive Manufacturing, Solidification, Phase boundary anisotropy, Synchrotron

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