عنوان مقاله:

On the Substructure Development and Continuous Recrystallization in the Course of Selective Laser Melting of ۳۱۶L Stainless Steel

محل انتشار:

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نویسندگان:

Z. Abbasi - *School of Metallurgy & Materials Engineering, Iran University of Science and Technology (IUST), Tehran, Iran*

H.R. Abedi - *School of Metallurgy & Materials Engineering, Iran University of Science and Technology (IUST), Tehran, Iran*

خلاصه مقاله:

In the present work, the selective laser melting (SLM) has been chosen as a controlled thermomechanical processing route in which the required temperature and strain for the occurrence of dynamic recrystallization is provided. The ۳۱۶L stainless steel as representative material was constructed by SLM under specified parameters (laser power, layer thickness, hatch spacing, scan strategy, and scan speed). The printed material's microstructure was carefully analyzed through electron back scattered diffraction. The presence of considerable fine grains (< ۲۰ μm) through the printed microstructure was considered as evidence for the occurrence of dynamic recrystallization during the manufacturing process. The high fraction of sub-boundaries (~۷۹.۷%) and sub-grains indicted the capability of the material for substructure development in the course of additive manufacturing process, and the fact that the new fine grains were formed through continuous dynamic recrystallization mechanism. The creation of plastic strains through the parts structure during SLM, which was required for dynamic recrystallization, was discussed relying on the expansion and contraction of the layers during repeated heating and cooling cycles. The amount of plastic microstrain was estimated to be around ~۰.۵۶ considering the layer thickness and depth of the melt pool. The hot compression tests were conducted at ۱۰۰۰ and various strain rates of ۰.۰۰۱, ۰.۰۱ and ۰.۱ s-۱ and the corresponding critical strains of dynamic recrystallization (~۰.۲) were calculated, which was well lower than those created during additive manufacturing process.

کلمات کلیدی:

Stainless steel, Selective laser melting (SLM), Cellular structure, recrystallization, Recovery