Phases identification and quantification of AISI 316L produced by laser powder bed fusion

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The additive manufacturing process by powder bed fusion (L-PBF) consists of the incidence of a high power laser on the material that promotes the fusion and later the solidification layer by layer creating the 3D from a computational model. The main advantage of this process is the fabrication of objects with complex geometries.

AISI 316L steel is widely used in the additive manufacturing process because it has good weldability. Due to good corrosion resistance, it is used as a biomaterial for the manufacture of implants.

The high temperatures achieved in the L-PBF process can cause phase transformation, in which part of the austenitic phase (FCC) is transformed into the martensitic phase (CCC), affecting its corrosion resistance.

The purpose of this work is the crystallographic characterization by X-ray diffraction of AISI 316L in powder form and after additive manufacturing by L-PBF.

The powder used in the process was gas atomized, with an average particle diameter of 50 micrometers. The parts were manufactured using the Yb laser (wavelength 1060 nm) with a scan speed of 1200 mm/s and power of 147 W, 184 W and 211 W.

The powder was characterized by SEM for morphological analysis and by X-ray diffraction for phase identification and quantification. The manufactured samples were characterized by SEM and MO, to observe the microstructure, and by X-ray diffraction to identify and quantify the phases present.

After the additive manufacturing process, with the increase in laser power, it was possible to observe, in addition to the austenite, the presence of the ferritic phase.