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PROCEEDINGS

Mechanical Properties of CP Ti Processed via a High-Precision Laser Powder Bed Fusion Process

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ABSTRACT

Because of its higher specific strength and better biocompatibility, commercially pure titanium (CP Ti) is widely used for product fabrication in the aerospace, medical, and other industries. Currently, different ways are adopted to strengthen CP Ti, such as solid-solution strengthening using oxygen or adding metal components to form alloys; however, the introduction of oxygen, other gases, or alloying elements reduces the corrosion resistance and biocompatibility. Herein, CP Ti with a low oxygen content was used to fabricate samples via a high-precision laser powder bed fusion process. Smaller laser beam diameter and thinner layer thickness lead to higher solidification and cooling rates of the melt pool, aiding the formation of fine acicular martensite grains and resulting in a higher yield strength. The highest yield strength of 619 MPa was obtained for an energy density of 116 J/〖mm〗^3. A higher energy density leads to an unstable molten pool and more pores and cracks, which could significantly reduce sample elongation, while an inappropriate laser power and scanning speed could result in poor surface quality. The aforementioned results and analysis could provide inspiration for the high-precision additive manufacturing of pure Ti.

KEYWORDS

Micro laser powder bed fusion, CP Ti, high yield strength, fine grains

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