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PROCEEDINGS

Refined Microstructures and Enhanced Strength of In-Situ TiBw/Ti-6.5Al-2.5Zr-1Mo-1V Composites by Selective Laser Melting

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ABSTRACT

Ti-6.5Al-2.5Zr-1Mo-1V alloy is a near α titanium alloy, which has been widely used in aerospace fields due to its low density, high specific strength, good corrosion resistance and high-temperature durability. To further improve the strength and high-temperature durability of Ti-6.5Al-2.5Zr-1Mo-1V complex components, the spherical Ti-6.5Al-2.5Zr-1Mo-1V alloy powder with a particle size of 15~53 μm and TiB_2 powder with a particle size of 0.5~1 μm were used to fabricate in-situ TiBw reinforced Ti-6.5Al-2.5Zr-1Mo-1V composites through low energy ball milling and selective laser melting (SLM). The results show that the TiB whiskers are uniformly distributed in the TiBw/Ti-6.5Al-2.5Zr-1Mo-1V composites, and the columnar grains with inner acicular α' martensite were formed along the building direction. In addition, the TiB reinforcement effectively refined the size of the matrix grains. Based on the load transfer and grain refinement strengthening mechanisms, the maximum room temperature tensile strength of TiBw/Ti-6.5Al-2.5Zr-1Mo-1V composite reaches up to 1446 MPa with an elongation of 4.1%, which is~17% higher than that of Ti-6.5Al-2.5Zr-1Mo-1V (1228 MPa). Furthermore, the tensile strengths of as-printed TiBw/Ti-6.5Al-2.5Zr-1Mo-1V at 550 °C, 600°C, and 650 °C are 870MPa, 700MPa, and 480MPa respectively.

KEYWORDS

TiBw/Ti-6.5Al-2.5Zr-1Mo-1V-0.5Si composite; selective laser melting; microstructure; mechanical property; strengthening mechanism

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