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Microstructure and Mechanical Properties of Ti-15Mo-xTiC Composites Fabricated by in-situ Reactive Sintering and Hot Swaging

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Abstract

TiC reinforced titanium matrix composites are promising for advanced applications. Generally, the relative density of the composites and the interfacial bonding between the matrix and reinforced particles may have a great influence on the mechanical properties. This study presented the fabrication of the full-densified Ti-15Mo-xTiC (x=1.5, 3.0, 4.5 wt.%) composites through in-situ reactive sintering of Ti, Mo, and MoC powders and hot swaging process. Experimental results show the formation of TiC and the absence of MoC in the fabricated composites. After hot swaging, the TiC particles showed aligned distribution along the swaging direction, and exhibited well bonding with the β-Ti matrix. Increasing the TiC content leads to increase tensile strength and Young's modulus but decrease elongation. Ti-15Mo-4.5TiC offers and outstanding combination: ultimate tensile strength=1290 MPa, yield strength=1075 MPa, Young's modulus=89 GPa, and tensile elongation=3.1%. The strengthening effect is attributed to Mo solid solution in Ti matrix, β-Ti grain refinement, and TiC particle reinforcement. The specific contribution of each mechanism is quantitatively calculated, showing good agreement with the experimental data.

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