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Improved fatigue properties with maintaining low Young's modulus achieved in biomedical beta-type titanium alloy by oxygen addition

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Abstract

Oxygen was added into biomedical β -type Ti-29Nb-13Ta-4.6Zr (mass%, TNTZ) alloy to improve its fatigue properties with maintaining its low Young's modulus. The effect of oxygen on the fatigue behaviors of these oxygen-added TNTZ alloys was systematically investigated. A series of TNTZ-(0.1, 0.3, 0.5 and 0.7 mass%)O alloys were prepared, denoted as 0.1O, 0.3O, 0.5O, and 0.7O, respectively. The Young's moduli of the prepared alloys increase slightly with increasing oxygen content; 0.7O possessing the highest oxygen content still shows a quite low Young's modulus. The fatigue limits of the alloys increase monotonically with oxygen content increases. The high-concentration oxygen in 0.7O suppresses the slip plane decohesion and induces the formation of densely-arranged small-scaled α'' martensite twins that increases the paths and distance for fatigue crack propagation, thus it enhances the resistance to the fatigue crack initiation and propagation in 0.7O, which contributes to its excellent fatigue performance.

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