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The Effects of Nb and Mo Addition on Microstructure and Mechanical Behaviour of Ti-6Al-4V Alloy

A. Kaouka[1]*, K. Benarous[2], A. Daas[1] and S. A. Tsipas[3]

[1]Laboratoire de Génie des Procèdes, Université Amar Telidji – Laghouat, B.P. 37G Laghouat 03000 Algeria; a.kaouka@lagh-univ.dz
[2]Laboratoire de Sciences Fondamentales, Université Amar Telidji – Laghouat, B.P.37G Laghouat 03000 Algeria
[3]Departamento de Ciencia e Ingeniería de Materiales, Carlos III Universidad, 30, 28911 Leganés, Madrid, Spain

Abstract

The effects of Nb and Mo addition, with different contents, on the microstructure and some mechanical properties of Ti-6Al-4V alloy were investigated. Treatments were performed at various high temperatures about 1200 and 1300 °C for 3h using vacuum furnace as first treatment and using an argon atmosphere as second treatment. The samples were characterized by X-ray diffraction and the influence of processing temperature on microstructure was studied, the microstructural evolution was evaluated by optical microscopy and SEM. The results revealed that the Nb and Mo elements added to the titanium alloy stabilized the β phase and changed the lattice parameters of α phase. Microstructural observations, phase analysis shown that Ti-6Al-4V alloy contain single phase and increasing Nb and Mo contents the equiaxed grain is refined, and reduction in the prior β grain size. Moreover, Nb/Mo addition up to 10 wt.% increases the volume fraction of β phase in the microstructure. Some mechanical properties such as hardness, Young's modulus and fracture toughness were achieved and tensile test was performed at room temperature. Experimental results revealed good mechanical properties including a low Young's modulus and high deformability, the hardness values of the alloy is about 350–570 HV and the fracture toughness values K_{IC} are ranging from 16.8 MPa $m^{1/2}$ to 28.5 MPa $m^{1/2}$ depending on Nb/Mo contents.

Keywords: Molybdenum, Microstructure, Microhardness, Niobium, Ti-6Al-4V Alloy, Young's Modulus