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The effect of solution treatment on the microstructure and mechanical properties of as-cast Ti-Mo alloys

Moshokoa, Nthabiseng; Raganya, Mampai L; Obadele, BA; Olubambi, PA; Machaka, Ronald

Abstract
The present study investigates the effect of solution treatment on the microstructure and mechanical properties of as-cast Ti-Mo alloys. The two alloys (Ti-8Mo and Ti-9Mo) were fabricated using a commercially available Arc re-melting furnace. Thereafter, the ingots were subjected to solution treatment and then quenched in ice water. Phase identification, microstructural analysis and fracture surfaces of both the as-cast and solution treated alloys were investigated using the X-ray diffraction (XRD) and Optical microscope (OM). The mechanical properties of both the alloys in the as-cast and solution treated state were characterized using the tensile test to obtain the elastic modulus and 3-point bend test to get the bending properties. The XRD results for Ti-8Mo alloy in as-cast and solution treated condition show dominant a phase peaks and Ti-9Mo alloy in as-cast condition show the dominant ß phase peaks and a phase peaks. However, the XRD showed a phase peaks after solution treatment. The optical micrographs of both alloys in as-cast condition show equi-axed beta grains with sub-grain boundaries within the grains. On the other hand, the Ti-9Mo alloy show needle like structure within the beta equi-axed grains after solution treatment while the Ti-8Mo show only needle like structures without beta equi-axed grains. The fracture surfaces after tensile test in the as-cast condition display cleaved and dimple features of various sizes while the fracture surface of the alloy after solution treatment show only dimple features. The elastic modulus obtained after tensile test decreases after solution treatment. The bending strength of Ti-8Mo alloy decreased after solution treatment whereas the Ti-9Mo alloy show a significant increase in the bending strength after solution treatment.