Fatima Jaffar Mohammed Al-Hassani . Effect of Alloying Element on the Ti-Ta Shape Memory Alloys . University Of Technology
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Abstract

In this study a systematic attempt has been made to develop new Ni-free SMAs composed of Ti and non toxic element. Titanium-Tantalum shape memory materials have widespread potential in biomedical applications due to their high degree of biocompatibility, favorable mechanical properties, high corrosion resistance and the possibility of exhibiting shape memory behavior. In this research the alloy has been produced by powder metallurgy approach and Ni element has been replaced by Ta element at fixed percentage 30 at%, then the alloying element (Mo and Al) has been added in different compositions (1 at%, 2 at% and 3%) to the master alloy (70% Ti -30% Ta) in order to study the effect of these elements on SMA. After samples preparation have been examined by using XRD, SEM technique, DSC, Vickers hardness, Archimedes method to measure the porosity percentage and corrosion rate in different solutions (artificial saliva, Ringer solution and blood plasma).The XRD and microstructure results show that all samples with and without additives consist of two phases (β-phase) and (α-phase) at room temperature and the addition of Mo and Al in these percentages does not have effect on present phases. The transformation temperature decreases with increase in Mo and Al percentage. The Ms temperature decrease compared to the binary Ti-30Ta alloy, indicating that the β- phase becomes more stable against α-phase with the addition of the alloying element. The addition of Mo and Al leads to lower the hardness and porosity compared with master sample (without additives).From the corrosion results we can see in 3% Mo the alloys have less corrosion rate than the master or other percentage (1 at% and 2 at%) in all solutions (artificial saliva, simulated body fluid (Ringer solution) and blood plasma) but the Al has a good corrosion rate in (artificial saliva and blood plasma). Finally it is observed that the Ti-Ta shape memory alloys with these types of additives are suitable for use in human body as implants or in dental applications.

Keywords: Titanium-Tantalum shape memory materials, XRD, SEM technique, DSC, Vickers hardness, Archimedes method, corrosion rate.