Effect of Annealing on Surface Oxidation of Ti-50.8 at% Ni Shape Memory Alloy

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Abstract

Nowadays, the used of NiTi shape memory alloys in biomedical field is growing exponentially linear with technological advancement. With all great benefits from NiTi, however, they also come with certain level of toxicity that can harm human's health sourcing from the Ni itself. Many techniques have been developed to contain this Ni from leaching out from the NiTi shape memory alloys. Among the techniques, thermal oxidation via annealing treatment is chosen where TiO2 is expected to form on the surface of the NiTi shape memory alloys and may act as a barrier to prevent the Ni from leaching out. Therefore, this research investigates the effect of annealing treatment to produce the optimum thickness of the oxide layer with good martensitic transformation behavior. In this case, NiTi was annealed from 400 degrees C to 700 degrees C for duration of 10 to 300 minutes in a furnace. The thickness of oxide layer was characterized using SEM and the transformation behavior was analyzed using DSC equipment. Based on the results obtained from SEM and DSC, by increasing annealing temperature and time, the thickness of the oxide layer increases and more even, however, it reduces the enthalpy change. Therefore, samples annealed at 600 degrees C for 50 to 150 minutes is an optimum parameter to produce the appropriate thickness and uniformity of the oxide layer (similar to 22 - 26 mu m) with reasonable Ms and enthalpy changes (Delta H-A -> M = 7.50 to 9.62).

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