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Investigation of annealing treatment on surface of porous NiTi alloy
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Abstract
Porous Nickel-Titanium (NiTi) alloy has been developed especially in the biomedical sector due to its shape memory ability and its mechanical properties which is comparable to human bones. However, NiTi alloy carries the risk of Nickel (Ni) ions leaching when implanted in the human body making it less favourable for biomedical use forlong term. Therefore, the goal of this research is to passivate the porous NiTi by oxidizing the surface via annealing treatment. Initially, the porous NiTi alloy was fabricated via powder metallurgy technique with addition of Calcium Hydride (CaH2) as a pore forming agent. Here, the degree of porosity was measured and the pore morphology, phase identification and transformation behavior were characterized by Scanning Electron Microscope (SEM), X-Ray Diffractometer (XRD), and Differential Scanning Calorimeter (DSC), respectively. Then, the surface treatment was performed by varying annealing temperatures where the oxide layer formation was characterized by using SEM and Energy Dispersive Spectrometer (EDS). The result shows that the sample's porosity increased by up to 42% from its theoretical density, demonstrating that the weight percentage of the pore-forming agent has a significant effect on theporosity of the NiTi alloy. For surface treatment, at higher annealing temperature i.e. 500°C, it produced a thicker oxide layer of TiO2 as compared to samples annealed at 300°C and 400°C. This indicates that the annealing temperature highly affects the formation of oxide layers on the surface. This oxide layer adheres well to the NiTi alloysurface and is expected to prevent the Ni ion from releasing, thus making this porous NiTi biocompatible metal.

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