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Effect of Annealing on Surface Morphology of Porous NiTi Shape Memory Alloy

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Abstract

The effect thermal annealing on the surface morphology of porous NiTi shape memory alloy by forming the in-situ oxide layer was studied. The porous samples fabricated via powder metallurgy was thermal annealed at various temperatures ranging from 300 to 700°C. A scanning electron microscope equipped with an energy dispersive spectrometer and an x-ray diffractometer were used to analyze the surface morphology and identify the phases, respectively. After annealing, the samples were tested for biocompatibility to evaluate the Ni ion leaching using an inductive pair plasma mass spectrometer. It was found that a stable TiO₂ layer is formed on the surface of the porous NiTi alloy during annealing. However, at higher annealing temperatures, a thicker unstable and brittle TiO₂ oxide layer is formed, resulting in an increased release of Ni ions. Overall, the development of a porous NiTi alloy with a passivated surface through thermal annealing has shown promising outcomes for potential applications in the biomedical field. © Springer Science+Business Media, LLC, part of Springer Nature 2026.

Author keywords

biocompatibility; NiTi alloy; porous; shape memory alloy; surface morphology; thermal annealing

Indexed keywords

Engineering controlled terms

Annealing; Binary alloys; Mass spectrometers; Morphology; Powder metallurgy; Scanning electron microscopy; Shape memory effect; Titanium alloys

Engineering uncontrolled terms

Memory alloy; Ni ions; NiTi alloys; NiTi shape memory alloys; Oxide layer; Porous; Porous Ni-Ti; Porous Ni-Ti alloys; Shape-memory; Thermal-annealing

Engineering main heading

Surface morphology; Titanium dioxide

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