**Ni-Ti Surface with Depressed Ni Concentration Prepared by Plasma Immersion Ion Implantation**


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**Abstract**

The plasma-immersion ion implantation (PIII) technique was used to modify and improve the surface of a Ni-Ti alloy (≈ 50.2 at.% Ni) for biomedical applications. The main goal has been the formation of a Ni-depleted surface, which should serve as a barrier to out-diffusion of Ni ions from the bulk material. Ion implantation of oxygen was carried out. The depth profiles of the elemental distribution in the alloy surface region, obtained by Auger electron spectroscopy (AES), confirm the formation of a Ti-rich oxide layer. The working plan also comprised ion implantation of nitrogen. In this case, the formation of titanium oxynitride (TiNₓOᵧ) was observed. The AES depth profiles show a Ni-depleted fraction for experiments performed with 40 keV.

**Experimental**

Aim: B2 phase → superelasticity

Ni-Ti alloy (≈ 50.2 at.% Ni); preliminary experiments were carried out to study the influence of the heat treatment temperature and duration. High temperatures promote the presence of the R-phase at body temperature.

PIII: The sample holder was not intentionally heated (T < 125°C)

**Results**

**Compositional analysis**

- **XRD studies at RT**
  - Diffraction peaks of NiTi, NiTi (1h), NiTi (6h), NiTi (1h)

**SEM observations**

- **Electrochemical impedance spectroscopy**
  - B19' Ni, R-phase, E. Alves

**Summary**

- PIII creates a graded interface between the modified surface and the bulk.
- It is possible to tailor the properties of the top layer, especially its barrier function against the out-diffusion of Ni.
- The high value of film resistance (Electrochemical impedance spectroscopy) suggests a very good corrosion resistance, which can be associated with the low Ni concentration at the surface of film.
- The high temperature necessary for thermal oxidation and nitriding would lead to alteration of the phase transformation characteristics and loss of specific mechanical properties of the alloy.

**Acknowledgements:** The authors would like to thank Filomena Batista for substrate preparation, Mario Steinert for technical assistance during the PIII experiments and Dr Nuno Franco for technical assistance during the XRD studies. Dr Luis Fernera is also kindly acknowledged for facilitating the DSC experiments. This work has been supported by the European Community under EC contracts no. 227012, 025646 and 226716. Rui Martins acknowledges FCT/MEC for his contract under IF2014 Programme.

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