

SURFACE MODIFICATION OF TI-NI SMA BY NITROGEN PLASMA IMMERSION ION IMPLANTATION (PIII) – PRELIMINARY RESULTS

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1. Introduction

Nickel–titanium (NiTi) shape memory alloys are promising materials for surgical implants due to their shape memory and super-elasticity. Studies have also reported that nickel ions leached from the alloys cause toxic reactions in humans, more severely in nickel hyper-sensitive patients resulting in strong allergic reactions. The use of the PIII process aims to avoid this negative effect of nickel release through the nitrogen ion implantation in the alloy surface in that way keeping the Ni into deeper layer [1-2].

2. Experimental

This work presents the effects of surface modification by the use of nitrogen plasma immersion ion implantation (PIII), varying temperature, and exposure time as follow: <250°C/2hours, 290°C/2hour, both by achieved by ion bombardment heating and 560°C/1hour using additional sample holder heating. The samples were taken from Ti-49.93at% Ni SMA produced by the ITA group using vacuum induction melting (VIM) process. The surface of the material was characterized by Scanning Electron Spectroscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDS).

3. Results and Discussions

From the surfaces of the implanted samples analyzed by SEM, can be noted structural changes and roughness modifications introduced by the PIII in condition of 290°C/2hours (by ion bombardment heating) and 560°C/1hour (using sample holder heating). On the other hand, uniformity of the sample surface layer under the experimental condition of <250°C/2hour (by ion bombardment heating) was observed. The EDS technique carried out on the treated samples demonstrated the presence of nitrogen for the three different PIII parameters. The experimental condition with additional sample holder heating showed higher oxygen amount suggesting the present of large amount of titanium oxide (TiO), which led to increase passive layer and consequently enhanced corrosion resistance of the material.

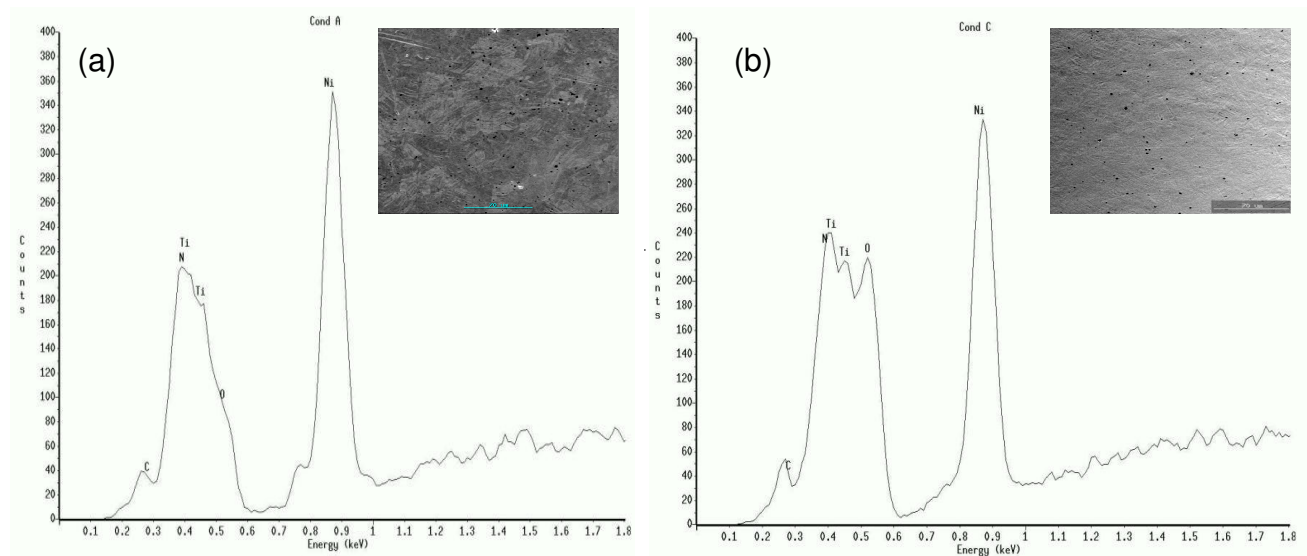


Fig. 1. Spectrum of X-ray absorption for samples of the alloy Ti-N with (a) PIII experimental condition of <250°C/ 2 hours and (b) PIII experimental condition of 560°C/ 1 hour. At the top of the spectra are presented surface structures of both experimental conditions with 500x resolution in which they were examined by SEM.

4. References

- [1]- J. Otubo, P. R. Mei, S. Koshimizu “*Materiais com efeito de memória de forma, características principais e aplicações*”, XIV Congresso Brasileiro de Engenharia Mecânica, COBEM' 97, Bauru, SP (2007).
- [2]- J. Humbeeck “*From a seed to a need: The growth of the shape memory application in Europe*”, Material Research Society Proceedings, **246**, 377-387, (1992).

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