WEAR RESISTANCE ANALYSIS $NI_{50,8}$TI SMA BY POWDER METALLURGY MODIFIED BY PLASMA IMMERSION ION IMPLANTATION TECHNIQUE

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1. Introduction

The shape memory alloys have been application in some areas such as: naval, aeronautic, automobilist. This is a promissor material in biomedical areas due to de shape memory effect and superelasticity proprieties. Actually, the porous alloys have been very interesting for utilized as biomaterial mainly for a hard bone tissue substitution by has structural characteristics similar the body bone. The porous SMA produced by powder metallurgy has shape memory effect and shown better microstructure homogeneity, excellent finishing surface and controlled porosity this aspects improvement of the osteointegration and loss elastic modulus. . However, studies indicate possibility nickel release that can be occurs toxic reactions and rejection as when used in form of prosthesis [1-4].

The Nitrogen Plasma Immersion Ion Implantation (N-PIII) technique is a possibility for reduction the nickel release and improves the tribological proprieties through of the modification structural and chemical that the change the growth oxides and nitrates rates in implanted alloys [3].

2. Experimental

For production of the $Ni_{50,8}Ti$ alloy by powder metallurgy were used as starting material elemental powders Ni (size 62 µm) and Ti (size 250 µm). The powders were manual mixed in 20 minutes. The sample was compressed varying the applied pressure between 50 MPa and 250 MPa in the cylindrical form with 10 mm in diameter and 2 mm in thickness .The sintering was performed at 900 ºC for 120 minutes. The N-PIII technique was realized at 770 ºC for 60 minutes.

The microstructure of as cast and implanted by PBII samples were observed with scanning electron microscope. The phase's identification and structural parameters were established using the X ray diffraction. The measurements of friction coefficient were accomplished in a CSM Instruments Pin-on-disc-Tribometer, computer controlled, SN 18-393, with 5 cm/s of linear speed, applied load of 1N, 3.18 mm of wear track radius, stopping at 5.000 revolutions at room temperature in air. Alumina ball-3 mm-diameter, supplied by CSM-Instruments was used. Disk volume loss and wear rate were calculated according to equations in the ASM G-99 norm.

3. Results and Discussions

The microstructure before N-PIII shows low heterogeneity and high porosity with open porous and interconnected. In XRD analysis, the difratogram demonstrated stable phase, $NiTi_3$ and $NiTi_2$ peaks and NiTi intermetalic phases, important for shape memory effect in these alloys. The microstructure of the sample after the N-PIII has less quantity of the porous in the surface. Furthmore it presented aleatory phases rich in Ni.

The wear resistance before and after plasma implantation were analyzed and the friction coefficient for the implanted sample presented an average around 0.2, showing low coefficient compared with as-cast sample which has coefficient close to 0.9.

4. References

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