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# Nitriding of maraging steel grade 300 by plasma immersion ion implantation

Jonathan Fernández<sup>\*1</sup>, Cristina Díaz<sup>1</sup>, Jose García<sup>†‡1</sup>, and Stephan Mändl<sup>§2</sup>

<sup>1</sup>Asociación de la Industria Navarra (AIN) – Asociación de la Industria Navarra, Carretera Pamplona 1, 31191 Cordovilla, Spain, Spain

<sup>2</sup>Leibniz-Institut für Oberflächenmodifizierung (IOM) – Leibniz-Institut für Oberflächenmodifizierung, 04318 Leipzig, Germany, Germany

## Abstract

Maraging alloys are a group of ultra-high strength steels that differ from other steels in their hardening process that is produced by the precipitation of intermetallic compounds during a heat treatment (ageing). This ageing process is carried out typically for 2-4 hours at 450-510 °C. These alloys are susceptible to be treated by means of thermochemical processes to improve their surface mechanical properties, such as hardness, corrosion and wear resistance.

In this investigation, a simultaneous thermochemical and ageing treatment on the annealed state material has been used to modify the superficial properties in comparison with the standard aged maraging steel. The treatment is a nitriding process based on plasma immersion ion implantation (PI3) and also to obtain. This paper focuses on describing the methodology of the technique and the characterization of the maraging steel specimens that have been treated.

A series of different nitriding processes have been applied on just annealed and aged maraging steel grade 300. In these processes, temperature and treatment times have been varied to study the evolution of the ageing process and the nitrogen profile diffusion.

The samples have been characterized by chemical in-depth profiling, roughness measurements, Knoop micro-hardness profile tests, wear resistance tests at room temperature and 450 °C and potentiodynamic corrosion tests. The microstructural characterization was realized by XRD analyses and scanning electron microscopy.

The layer thickness observed ranged between a few hundred nanometers and 50 microns, depending on the temperature reached in the process. The nitriding processing increases the superficial hardness, corrosion and wear resistance of aged maraging steel. The simultaneous thermochemical and ageing process on annealed maraging steel has been successfully developed, achieving similar properties than the two-steps treated material.

**Keywords:** maraging steel, ageing, nitriding, plasma immersion ion implantation

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\*Corresponding author: jfernandez@ain.es

†Speaker

‡Corresponding author: jagarcia@ain.es

§Corresponding author: stephan.maendl@iom-leipzig.de