A comparison of spark and soft PEO regimes in terms of corrosion and wear performance on AZ31 alloy

***Lara Moreno*[1], *Véronique Vitry*[2], *Marie-Georges Olivier*[1,3]**

1) *Materials Science Department, Faculty of Engineering, University of Mons, 20, Place du Parc, Mons, 7000, Belgium*

2) *Metallurgy Department, Faculty of Engineering, University of Mons, 20, Place du Parc, Mons, 7000, Belgium*

3) *Materia Nova Research Centre, 1, Avenue N. Copernic, Parc Initialis, Mons, 7000, Belgium*

Abstract

Plasma electrolytic oxidation (PEO) is an excellent technique for the surface modification of Mg alloys for biodegradable implants due to it improves the corrosion resistance of the alloys and promotes cell adhesion and proliferation. However, PEO coatings have a high internal porosity that can affect their functionality in a short period of time. To reduce this porosity, the soft regime is used, which employs lower current densities and a controlled and less intense arc or spark; in contrast to the spark regime, which requires higher current density and spark intensity to form the coatings with high porosity and less compactness. In this work, the soft regime was explored in comparison to the spark regime to produce dense PEO coatings with good corrosion and wear properties. The coatings were carried out on AZ31 alloy in an alkaline electrolyte containing silicate and a low fluoride content. The influence of frequency, duty cycle and current density in the soft regime was investigated, while the effect of voltage, current density, process time and ramp time in the spark regime was determined. These parameters were examined in terms of morphology/composition, thickness, corrosion and wear resistance. The composition and morphology of the coatings were analyzed by SEM and XRD. The corrosion behaviour the coatings was evaluated in SBF by EIS and H_2 evolution test at 37°C. The wear behaviour was carried out by dry alternating sliding at room temperature. The influence of the studied PEO parameters in the soft regime is discussed in terms of alloy degradation mechanisms and wear behaviour in comparison with the coatings obtained in the spark regime.

***Keywords**: Mg, soft and spark regime, corrosion and wear resistance.*