CORROSION AND WEAR PROTECTION OF MG ALLOYS BY PEO PROCESSING

Carsten Blawert, Xiaopeng Lu, Yan Chen, Junjie Yang, Xun Ma, Nico Scharnagl, Daniel Höche, Maria Serdechnova, Sviatlana Lamaka, Mikhail Zheludkevich

Helmholtz-Zentrum Geesthacht, Max-Planck-Str. 1, Geesthacht, Germany
e-mail: carsten.blawert@hzg.de

The PEO process (plasma electrolytic oxidation) converts the magnesium surface to hard and thick ceramic-like coatings composed of high temperature crystalline oxide phases formed due to local dielectric breakdown of the oxide film and formation of micro arc discharges. Unfortunately, the discharges also introduce defects to the coatings such as discharge channels, pores from gas inclusions and cracks, with negative effects on the corrosion resistance. Such defects are quite critical for magnesium alloys, because they are offering fast path-ways for the electrolyte to reach the substrate and to initiate corrosion. Thus reducing the defects and introducing stable phases to PEO coatings is an essential requirement for most of the industrial applications to improve the corrosion resistance. In contrast the requirements for biomedical applications of magnesium are significantly different as they are considered as degradable implants and coatings must degrade as well. Furthermore, in many applications it is desired to add additional functionalities to Mg surfaces via PEO processing and multifunctional coatings with anticorrosion, self-lubrication, anti-wear, bioactive and photocatalytic properties which can be produced with the aid of additives to the electrolytes.

This presentation will focus on some of our research activities related to PEO processing of Mg alloys, including understanding of phase and coating formation, corrosion and wear properties of PEO coatings, use of additives and post-treatment options to add active corrosion protection and other additional functionalities and PEO coatings for biomedical applications. Microstructure-property relations are given to understand how PEO coatings can be tuned to the requirements of different applications or how duplex treatments can be used to add additional value.