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Surface modification of oxide-covered zinc and zinc alloys by means of DBD treatment

Steffen Knust[1], Andreas Czerny[2], Teresa de los Arcos[1], Claus-Peter Klages[2], Guido Grundmeier[1]

[1]University of Paderborn, Paderborn, Germany [2]Technische Universität Braunschweig, Braunschweig, Germany

sknust2@mail.upb.de

Zinc and zinc alloy coatings are widely used nowadays due to their corrosion protection properties in the automotive and building industries [1]. Within this frame, it is of great interest to investigate the adhesion properties of such coatings. The native surface of zinc and its alloys is typically covered with the respective natural oxides and hydroxides, which have an affinity to most adhesives typically used. Surface modification by plasma can be implemented in order to modify the surface chemistry and the electrical properties to further enhanced adhesion [2,3].
In this work, the surface of oxide-covered zinc alloy ZnMgAl as well as reference zinc oxide films are modified by atmospheric-pressure dielectric barrier discharges in different gas atmospheres (Ar, Ar/O2, Ar/H2O). This leads to a variation in the surface chemistry and electronic properties of the oxides. The chemical surface modification is correlated to adhesion properties as determined by peel force tests. The plasma treatment is performed in a self-designed setup, which allows the in-situ characterisation of the surface with discrete polarised infrared reflection absorption spectroscopy (DPM-IRRAS) and Kelvin probe (KP) measurements. The plasma was characterized by optical emission spectroscopy (OES). Further chemical characterization of the surfaces is done ex-situ by X-ray photoelectron spectroscopy (XPS).
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