

OR1903

Composite layers “MgAl intermetallic layer / PVD coating” obtained by hybrid surface treatment method on the AZ91D magnesium alloyJerzy Smolik¹, Adam Mazurkiewicz², Jarosław Mizera³

¹Institute for Sustainable Technologies, Radom, Poland ²Institute for Sustainable Technologies, Radom, Poland ³Warsaw University of Technology, Warsaw, Poland

jerzy.smolik@itee.radom.pl

The magnesium alloys are very interesting construction materials in aviation, automotive and machine industries as well as in production of portable electric devices. Their low densities from 1.75 to 1.85 g/cm³ and high specific strength give a chance of considerable reduce of energy. The main inconvenient feature of magnesium alloys which make difficult their applications is very small corrosion and tribology resistance.

This paper presents the technological process of creation of the composite layers consist of “intermetallic layer MgAl-PVD coating” on AZ91D magnesium alloy intended for anticorrosion and anti-wear applications. The investigated composite layers were obtained with the use of the hybrid surface treatment technology, which consist of diffusion treatment in Al powder followed by electron beam deposition method. Two different PVD coatings namely TiN and Al₂O₃ were obtained on the AZ91D magnesium alloy with the intermetallic layer MgAl on the surface.

The properties of the designed and created composite layers like as microstructure (FIB+STEM technique), phase structure (X-ray diffraction), chemical composition (GDOES method), adhesion (Scratch test) and mechanical properties (Nano Hardness Tester) were investigated. The paper also demonstrates the results of corrosion investigations (electrochemical corrosion test method) as well as tribology investigations (ball-on-disk method) carried out for AZ91D magnesium alloy covered by investigated composite layers.

The obtained results proved that hybrid surface treatment technology–diffusion treatment in Al powder+Electron–beam deposition, which was developed by authors, enable to significant increase of corrosion and tribology resistance of AZ91D magnesium alloy.

Keywords

magnesium alloys
intermetallic layers
duplex treatment
composite layers