POB009

Boosting the corrosion properties of PVD-TiMgGdN coated mild steels using sophisticated powder metallurgical TiMgGd targets

Holger Hoche[1], Thomas Ulrich[1], Peter Polcik[2], Matthias Oechsner[1]

[1]MPA-IfW, TU-Darmstadt, Darmstadt, Germany [2]Plansee Composite Materials GmbH, Lechbruck am See, Germany

hoche@mpa-ifw.tu-darmstadt.de

PVD-TiMgGdN coatings were successfully developed by the authors in an industrial DC-magnetron PVD unit, which reveal an excellent corrosion protection capability for mild steel substrates for at least 800 h in the salt spray test [1]. The MgGd was implemented in the coating by using segmented multi-component targets, consisting of segments of pure Ti and a Mg-30 wt.% Gd alloy.
The drawback of the segmented target was an increased defect density due to droplets forming at the gaps between the segments. In consequence, the wear performance was unsatisfactory. To overcome this problem, a TiMgGd target with a specific Ti:Mg:Gd ratio was manufactured by powder metallurgical technology processing pure metal powders.
In the present work, DC-PVD-TiMgGdN were synthesized with the new powder metallurgical TiMgGd targets by variation of the deposition parameters (power, BIAS, pressure, reactive gas portion). The influence of the deposition parameters on the resulting coating properties as well as the corrosion performance and the wear behavior were examined. The coatings were characterized concerning their microstructural, mechanical and chemical properties. Salt spray tests as well as electrochemical measurements were carried out to examine the corrosion properties. Furthermore, ball on disk wear tests were conducted by reciprocal dry sling tests by using a SRV 3 tribometer.
It is shown that the excellent corrosion performance, which was already observed for the segmented targets, could be boosted by application of the powder metallurgical TiMgGd sputter targets. Besides that, the wear performance is in the common range of typical nitride based PVD hard coatings deposited with the powder metallurgical targets. It was found that the deposition parameters show a minor influence on the mechanical coating properties but a major influence on the resulting microstructure, which directly correlates with the corrosion and wear performance.
[1] H. Hoche, C. Pusch, M. Oechnser, Surf. Coat. Tech. 376, 2019, 74.

Keywords
Magnetron PVD
Corrosion
Wear