

ORE201

Enhancing the corrosion protection capability TiN and CrN PVD coated mild steels by addition of Mg-Rare Earth

Holger Hoche, Thomas Ulrich, Casper Pusch, Matthias Oechsner

MPA-IfW, TU-Darmstadt, Darmstadt, Germany

hoche@mpa-ifw.tu-darmstadt.de

Today, innovative coatings must ensure wear protection and corrosion resistance for corrosive substrate materials, e.g. mild steel. Unfortunately, state of the art PVD coatings still lack in corrosion performance due to the low coating thickness and the presence of coating defects.

An innovative solution to improve the corrosion properties is alloying TiN or CrN based PVD coatings with MgRE (RE = Rare Earth). The authors developed monolithic TiMgGdN coatings of 4-5 μm thickness using an industrial magnetron PVD, which exhibit a superior corrosion resistance of at least 800 h in the salt spray test without any macroscopic corrosion attack [1].

In the present work, the influence and the effect various rare earth metals (Gd, La, Ce) on the coating properties and the corrosion performance was investigated. The chemical composition was varied using segmented multi-component targets consisting of segments of the coating material metals Ti and Mg-RE.

As benchmark, conventional PVD coatings, DLC and electroplated Cr were included in the examination. 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 of the coated specimens.

It will be shown that both, the corrosion performance as well as the mechanical properties can be optimized by the choice of the Mg-RE constituent and the TiN or CrN matrix material.

[1] H. Hoche, C. Pusch, M. Oechsner, Surface and Coatings Technology 376, 2019, 74.

Keywords

Magnetron PVD

Corrosion

Wear