

Enhancement of the corrosion properties by alloying binary magnetron sputtered DC-PVD-TiN coatings with MgGd

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PVD-TiMgGdN coatings sputtered with a powder metallurgical target 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 1000 h in the salt spray test [1].

After experimentally improving the mechanical, microstructural and corrosive properties of these coatings, this study will explain the mechanism of alloying MgGd into the TiN matrix. Therefore, binary TiN coatings were compared with TiMgGdN coatings regarding their microstructural, chemical, physical and corrosion properties. Corrosion properties were investigated by means of neutral and electrochemical tests. The coating surfaces were also analyzed by nanoindentation measurements and chemical analysis to gather knowledge of the coating stability during corrosive stresses.

It will be shown that the excellent corrosion performance is mainly influenced by the MgGd amount inside the coatings, which influences the open circuit potential between substrate and coating significantly. Moreover, the outcome of the investigations will show, that the MgGd amount has a minor influence on the mechanical coatings properties but a major influence on the resulting microstructure and the stability of the coating during corrosive stresses, which directly correlates with the corrosion performance.

[1] T. Ulrich, C. Pusch, H. Hoche, P. Polcik, M. Oechsner, Surface and Coatings Technology 422 (2021) 127496.