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PVD as an Alternative for Hard Chromium Plating: PVD-Coatings for Applications Under Complex Tribological and Corrosive Load Conditions

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Due to the health hazard, emanating from chromium trioxide based coating processes, the longtime approved hard chromium platings have to undergo a complex and cost intensive authorization procedure due to the European REACH directive from 2017 onwards. Therefore, the development of alternative coatings with comparable properties is a key demand for the coating industry. On the one hand alternative coatings have to achieve the requirements for hardness and corrosion resistance, and on the other hand fulfill the current sustainability criteria in terms of environment protection and health.

Recently, the authors developed a TiMgGdN coating system with improved corrosion properties, which protects even magnesium \square which is known as the most corrosive construction metal \square against corrosion for at least 300h in the salt spray test.

In the present work, the TiMgGdN coating concept has been developed for low alloyed steel substrates. The coating composition and the deposition parameters were varied to optimize the coatings for steel substrates. In addition, the Mg-Gd-alloying concept was tested for other typical tribological coating systems like CrN and ZrN.

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.

Furthermore, the electrochemical properties as well as the open circuit potentials of the coating materials themselves were determined.

It will be shown that alloying the base coating materials with Mg-Gd improves the corrosion properties of steel substrates. The corrosion performance of these coatings is superior in comparison to standard PVD coatings like TiAlN or CrN.

Keywords

TiMg(X)N

corrosion protection

PVD

coating development