
Surface modification and corrosion properties of implanted and DLC coated stainless steel by plasma based ion implantation

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Abstract

Properties such as corrosion resistance of a substrate depend on the composition and structure of the near surface regions. Hence, an implantation layer and/or a deposition layer are effective in reducing the susceptibility to corrosion.

Plasma based ion implantation and deposition was used for ion implantation and diamond-like carbon (DLC) film deposition on 304 stainless steel in order to study the surface modification and corrosion properties of samples as a function of treatment conditions. For this purpose both solely implanted samples and DLC deposited samples combined with different implantation conditions were used.

The working gas (nitrogen, oxygen and ethylene) for the plasma based ion implantation, the height of the voltage pulse (10 and 15 kV) and the pulse repetition rate were varied. The influence on the implantation structure was investigated with XRD, SIMS and XPS. The DLC film structure was characterized by Raman spectroscopy. The corrosion protection effect in sodium chloride solution was tested by cyclic voltammetry measurements in comparison with untreated stainless steel samples.

Depending on the process parameters differences in the depth distribution and implantation structure were found that led to improved corrosion properties.

Keywords: PBII&D, corrosion, steel

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