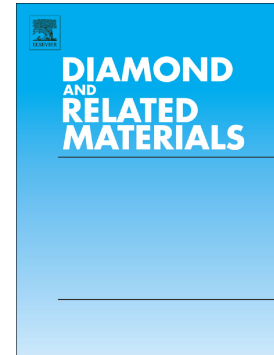


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Improvement in anti-corrosion property of hydrogenated diamond-like carbon film by modifying CrC interlayer

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Abstract

Hydrogenated diamond-like carbon (DLC:H) films with three different CrC interlayers were deposited on 304 stainless steel by reactive sputtering. The structure and composition of the films were investigated by Raman spectroscopy, SEM, EDS and XRD. To investigate the corrosion property of the films, potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) tests were performed in Hank's balanced salt solution. In this study, all CrC interlayers were in amorphous state. Gradient CrC or CrNC interlayers without elements abrupt change at the interface were bonded well with DLC:H, while constant CrC interlayer was bonded with DLC:H weakly. Constant CrC interlayer didn't realize the barrier effect of DLC:H and accelerated its own corrosion due to weak interface bonding. Gradient CrC interlayer ensured DLC:H high anti-corrosion property. Gradient CrNC interlayer further improved the corrosion resistance of DLC:H due to its own high anti-corrosion property.

Keywords: Hydrogenated diamond-like carbon film, CrC, Interlayer, EIS, Anti-corrosion

1. Introduction

Diamond-like carbon (DLC) attracts widespread attention and researches owing to its good comprehensive properties, such as low friction coefficient, chemical inertness, high biocompatibility, and its promising applications in biomedical materials, cutting tools, electronics and other fields [1]. A variety of methods have been adopted to prepare DLC, such as cathodic arc deposition, ion source deposition, sputtering, etc. However, DLC deposited by these methods has a common drawback of high internal stress, which results in weak adhesion to substrates and limited thickness, both are vital for application. Doping can effectively relieve the internal stress of DLC and enhance adhesion to some extent, but it depends on the doped element and amount

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