Short Communication

Effect of Deposition Pressure on the Microstructure and Corrosion Resistance of Diamond-Like Carbon Films Prepared by Plasma Enhanced Chemical Vapor Deposition

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To improve the corrosion resistance of biomedical stainless steel in bodily fluids, a diamond-like carbon (DLC) film deposited on steel has been developed by plasma enhanced chemical vapor deposition (PECVD) technology using methane and argon as gas sources. Through adjusting the deposition pressure, DLC films with different microstructure can be obtained. Upon an increase in pressure from 0.6 to 3 Pa, the degree of graphitization of the DLC film first increases and then decreases. The formation of small graphite clusters releases internal stress in the material and increases the density of the DLC film. Meanwhile, the increase in density prevents electrolyte diffusion to the substrate surface, which increases corrosion resistance. At a pressure of 1 Pa, the degree of graphitization is relatively high with an ID/IG value of 0.6, and a more dense DLC film is obtained. From the electrochemical impedance spectroscopic (EIS) fitting results, the charge transfer resistance in 0.9 wt.% NaCl solution is higher than $6 \times 10^8 \Omega \cdot \text{cm}^2$, i.e. the corrosion of the substrate is very slow. At a deposition pressure of around 1 Pa, the DLC film shows obvious protection of the stainless steel substrate.

Keywords: PECVD, DLC film, deposition pressure, microstructure, graphitization degree, corrosion resistance

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