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Low stress, nanostructured, biocompatible DLC coatings prepared by thermionic vacuum arc method

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A method based on thermionic vacuum arc (TVA) plasma [1] was developed to grow nanostructured, diamond-like carbon (DLC) films in order to be used as protective, biocompatible coatings of silicon neuronal probes. The carbon films deposited on witness samples made of mirror-polished Si and glass substrates were identified as DLC phase with sp^3 bonds over 60% and diamond crystallites of 3-11 nm in diameter. Atomic force microscopy (AFM), high resolution electron transmission microscopy (HRTEM) and X-ray photoelectron spectroscopy (XPS), were used to characterize the morphology and the phase composition of the DLC films after the growth stages. In order to minimize the internal stress and to obtain films with increased adherence, low concentration of Ag, Ni and W elements were deposited simultaneously with carbon using TVA method. By Raman spectroscopy was identified the C phase of the deposited films using the 514.5 nm line of an Ar^+ laser with 5 mW power and 50 mm spot diameter: DLC phase, as defined by Ferrari and Robertson [2] with a large ratio of characteristic D-band/G-band intensities. The wetting contact angles of the prepared samples were improved by rf plasma treatment in CF_4 and O_2 glow discharges. The measurement results showed a drastically conversion of the hydrophobic DLC (124° contact angle) to hydrophilic DLC (69^0 contact angle) processed in O_2 rf glow discharge for 15 minutes. The biocompatibility of DLC films with thickness of 200 - 300 nm deposited on implantable probes was evaluated introducing the samples in a specific growing cell medium RPM 1640. The conclusion was that do not exist significant differences between the viability of the treated medium and the control medium, proving that the tested materials do not deliver in the growing cell medium, citotoxic products.

References

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Keywords

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