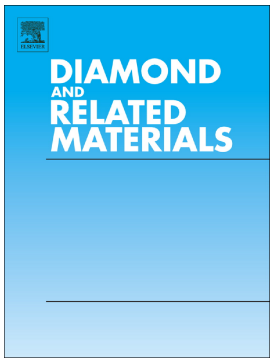

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Deposition of diamond-like carbon thin films by the high power impulse magnetron sputtering method

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Abstract

The goal of the conducted experiments was to evaluate if the increased density of the plasma in high-power magnetron sputtering (HiPIMS) argon discharge would give the possibility of obtaining diamond-like films with high sp^3 fraction content at room temperature. The magnetron cathode was driven by the self-designed supply. It consisted of high voltage supply, tank capacitors and a set of switches. The tank capacitors and the inductances of connecting wires formed a LC resonant circuit. As a result, each sputtering pulse (duration of 20 μs, peak current of 1500-2200 A) was followed by the inverse pulse (duration of 25 μs, peak current of 400-700 A), both having a sinusoidal shape. The repetition time was 3 s. The silicon substrates were placed 8 cm above the target surface. The sputtering processes of 99.99% pure graphite target were conducted in argon atmosphere at a pressure of $6\text{-}8\times10^{-3}$ hPa. The carbon films obtained after 400 deposition pulses had a thickness of 35 nm. The surface RMS roughness, measured using an optical profiler, was about 2 nm. The refractive index was estimated by means of ellipsometric studies to be 2.45 and 2.3 at 400 and 800 nm, respectively. The sp^3 hybridization fraction content of about 70-80% was calculated based on the analysis of Raman Scattering spectra.

Keywords

diamond-like carbon, film deposition, magnetron sputtering, HiPIMS, HPPMS