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HYDROGEN-FREE DLC COATINGS DEPOSITED BY HiP GIMS

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DLC-type carbon coatings produced by PA PVD methods were entered to the scientific circuit almost 50 years ago. In the production of hydrogen-free coatings by the PA PVD methods, the most effective synthesis environment is the high-energy plasma where dominates an ionization of carbon vapors via electron collisions. Such plasma is most efficiently generated by arc methods. However, these methods generally require a complex instrumentation that eliminates the emission of micro- and macro particles of the carbon target used as carbon vapor source. The use of high power magnetron sputtering (HiPIMS) seems to be a promising and competitive technique for producing carbon coatings due to the expected plasma properties necessary for the creation of sp^3 orbitals. Recently, more and more publications have started to appear in this area. In our research, we applied the HiPIMS technique too but contrary to the known solutions, at now the plasmoids generation was fully controlled by the working gas pressure pulses in the range of its critical values (Gas Injection Magnetron Sputtering, GIMS). The graphite target mounted in the unbalanced 50 WMK magnetron was the only source of the carbon vapors. The argon injected by the fast impulse valve to the inter-electrode space in the form of discrete gas pulses (pressure changes range of 10^{-3}-10^{-1} Pa in the gas pulse) was the sputtering gas and it played the role of the only discharge ignitron in the system. Carbon coatings were deposited on the unheated monocrystalline silicon wafers. The HiP GIMS (High Power GIMS) deposition process consisted of a sequence of 1000 plasma impulses generated at frequency of 0.5 Hz with the use of capacitor of 25-50 mF charged to the voltage of 1-2 kV as a source of the electric energy. As a result, for the best case of the plasmoids with the energy of about of 16 J, the 70% of the sp^3 hybridized carbon bonds were detected (Raman) in the phase composition of the carbon coatings.

Keywords
DLC coatings
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