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DLC Layers prepared by PLD with Ion BombardmentTomas Kocourek¹, Miroslav Jelinek¹, Jan Miksovsky¹, Petr Pisarik¹¹Institute of Physics ASCR, v. v. i., Praha, Czech Republic

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Physical and mechanical properties of diamond-like carbon (DLC) thin layers prepared by pulsed laser deposition with ion bombardment were studied. DLC films were fabricated by pulsed laser deposition technique (PLD). The film growth was modified during the deposition by ion bombardment with argon and krypton ions. The films with high and low diamond/graphite ratio were prepared by changing the laser energy density on the graphite target from 4 Jcm⁻² to 14 Jcm⁻². Energy of ions was changed by gun voltage and ionic current and was up to 210 eV. The content of sp² "graphite" and sp³ "diamond" bonds was measured using X-ray photoelectron and X-ray induced Auger electron spectroscopies. We found the highest sp³ content for ions bombardment of 40 eV. We studied mechanical properties of layers. Hardness and reduced Young's modulus were determined using the method Quasistatic nanoindentation and a special diamond Fluid Berkovich tip. Young's modulus was studied through the use of resonant ultrasound spectroscopy, too. Film adhesion was studied using scratch test and was up to 14 N for titanium substrates. Films were smooth as confirmed by profilometric and AFM measurements. Maximum Ra and RMS was not higher than 1.4 nm. The influence of ion bombardment and DLC films properties is discussed.

Keywords

Ion bombardment
Pulsed laser deposition
Diamond-like carbon
Mechanical properties
Thin layer