PO3066

Combination of DLC and organosilicon films in protective double layer structure on metallic substrates

Lenka Zajickova[1], Mihai Muresan[1], Vilma Bursikova[1], Pavel Ondracka[1], Daniel Franta[1], Vratislav Perina[2], Anna Charvátová-Campbell[3], Tomas Polcar[4]

[1]Masaryk University, Brno, Czech Republic [2]Institute of Nuclear Physics, Rez, Czech Republic [3]Czech Metrology Institute, Brno, Czech Republic [4]Czech Technical University, Prague, Czech Republic

lenkaz@physics.muni.cz

Hard amorphous hydrogenated carbon film, also called diamond like carbon (DLC), have proved their applicability in tribology and as protective coatings when combined with a suitable interlayer ensuring a good adhesion to the metallic substrate. Such interlayers are usually prepared by magnetron sputtering of W, Ti or Cr. If DLC is prepared by plasma enhanced chemical vapor deposition (PECVD) it is better to find a PECVD process for the interlayer deposition. The selection is, however, limited by availability of suitable volatile precursors and complexity of PECVD. Among the most studied are the mixtures producing nitrides and silicon-containing films. Although the adhesion can be also improved by doping the DLC matrix with N or Si these dopants have undesired effects like reduction of hardness, chemical resistance, friction coefficient. Some recent papers suggested silicon-based interlayers prepared from silane by PECVD. In this work we have tested an organosilicon (SiOCH) film prepared in capacitively coupled discharge at 13.56 MHz from mixtures of hexamethyldisiloxane (HMDSO) with oxygen. The optimized SiOCH films were prepared from 8% HMDSO/O_2. They have the hardness, low internal stress, high fracture toughness and good adhesion to metals. DLC films were prepared on the top of SiOCH in the same type of discharge from the mixture CH4 with either Ar or H2. The mechanical and tribological properties of the single and double layer coatings were investigated by depth sensing indentation, scratch and pin-on-disk tests. Hardness measurements ranged between 7 to 9 GPa for interlayers and 14 to 20 GPa for DLC layer. The friction coefficient for the double layered structure was as low as 0.05. Concerning the e pin-on-disc test, for 1N load and 1000 laps the wear rate was negligible Films structure was studied by optical methods in spectral range from UV to IR and determined by Rutherford Backscattering Spectroscopy (RBS) combined with Elastic Recoil Detection Analysis (ERDA).

Keywords
PECVD
DLC