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Study of mechanical, physical and chemical properties of a-C:H thin films deposited by reactive magnetron sputtering in d.c. pulsed mode.

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Amorphous hydrogenated carbon (a-C:H) thin films are widely used as protective coatings in several industrial applications due to their interesting properties such as high hardness, wear resistance and low coefficient of friction. The aim of this work is to establish a relation between the mechanical (hardness, Young's modulus and coefficient of friction), the physical and chemical properties (density, sp^2/sp^3 ratio and hydrogen concentration) of the as produced films. For that purpose, a-C:H coatings were deposited on polycrystalline polished copper substrates by reactive d.c. magnetron sputtering from a graphite cathode with acetylene as reactive gas. The bias voltage was set at +100, 0, -50, -100 or -150 V during the deposition process in order to modify the mechanical properties of the deposited layers. Mechanical properties were characterised by nano-indentation while the ratio between sp^2 and sp^3 chemical bonds and the concentration of hydrogen were studied by PM-IRRAS and ERD, respectively. Results discuss the correlation between the mechanical properties and the physical and mechanical characteristics of a-C:H thin films.

Keywords

Amorphous hydrogenated carbon
Reactive sputter deposition
d.c. pulsed mode
Acetylene
Mechanical properties