SiC THIN FILMS NANOSTRUCTURES OBTAINED BY THERMIONIC VACUUM ARC METHOD

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Abstract. *Thermionic Vacuum Arc method (TVA) was used to prepare Silicon Carbide (SiC) thin films. This method is very suitable for deposition of high purity thin films with compact structure and extremely smooth in vacuum conditions. Crystalline Silicon-Carbon (Si-C) thin films were prepared at substrate temperature between 200 °C and 1000 °C using TVA method. To increase the acceleration potential drop, a negative bias voltage up to -1000 V was applied on the substrate.*

SiC single-layer or multi-layer on C used to improve the oxidation resistance and tribological properties of C have been obtained. The 200 nm thickness carbon thin films was deposed on glass or Si substrate and then 100÷500 nm thickness SiC successively layers on carbon thin film was deposed.

Protective nitrogen doped Si-C multilayer coatings on carbon, used to improve the oxidation resistance of carbon, were obtained. The initial carbon layer having a thickness of 100 nm has been deposed on a silicon substrate in the absence of nitrogen, and then a 3nm Si thin film to cover carbon layer was deposed. Further, seven Si and C layers were alternatively deposed in the presence of nitrogen ions, each having a thickness of 40 nm. In order to form silicon carbide at the interface between silicon and carbon layers, all carbon, silicon and nitrogen ions energy has increased up to 150eV. To increase the energy of N, C and Si ions, -400 V, -600 V and -1000 V negative bias voltages was applied on the substrate at the 200 ^{0}C substrate temperature. The 400 nm, 600 nm and 1000 nm N-SiC coatings on glass was obtained.

The microstructure and physical characteristics of as-prepared SiC, Si-C and Si-C-N coatings were investigated by Transmission Electron Microscopy (TEM, STEM, HRTEM), Energy Dispersive X-Ray Spectroscopy (EDS), Electron Scattering Chemical Analysis (ESCA), Raman spectroscopy, SAED, Thermal Desorbtion Spectroscopy (TDS), X-Ray Photoelectron Spectroscopy (XPS), tribological techniques and electrical measurements.

Keywords: TVA method, SiC coating, TEM, STEM, EDS, ESCA, Raman Spectroscopy XPS

1. Introduction.

Technological development is significantly based on the discovery of new materials and processes. In this respect, nanomaterials are special due to their specific properties which are far from being completely explored. An important asset of materials at nanometer-scaled is the large range of fundamental properties that can be varied relative to the bulk materials only by changing the grain size and composition. Silicon carbide (SiC) is an important non-oxide ceramic which has several industrial applications.

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