NANOSTRUCTURED TI-C THIN FILMS DEPOSITED BY THERMIONIC VACUUM ARC (TVA) TECHNOLOGY

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Abstract. Nanostructured titanium-carbon nanostructured thin films were prepared using the Thermionic Vacuum Arc (TVA) technology in different configurations under a varied number of Ti/C combinations at high base pressure of 1×10^{-6}Torr with and without graded compositions. The layers consisting of about 100nm Carbon base layer and seven 40nm alternatively Ti and C layers were deposited on Silicon substrates. On the other hand, in order to obtain C-Ti multilayer structures with variable thickness and different percentages in C and Ti of layers, a 20nm thick C layer was first deposed on Si substrate and then seven Ti-C layers, each of these having thickness of up to 40nm were deposed. To perform the successively layers with various thickness were changed the discharge parameters for C and Ti plasma sources to obtain the desirable thickness. By changing of substrate temperature between room temperature and 300°C and on the other hand the bias voltage up to -700V, different batches of samples were obtained for this study. The films were characterized by surface morphology, and microstructure, through Rutherford Backscattering Spectrometry (RBS), Raman Spectroscopy, Transmission Electron Microscopy (TEM), Grazing Incidence X-ray diffraction (GIXRD). Tribological and electrical measurements are also presented.

Keywords: TVA, C–Ti multilayer, EDX, XPS, tribological properties, electrical properties, TEM, STEM

DOI https://doi.org/10.56082/annalsarsciphyschem.2022.1.107

1. Introduction

Titanium and carbon have outstanding properties that have led to their widespread use in several important technological applications. For instance, with the highest strength-to-density ratio of any metallic element and due to its high corrosion resistance, titanium is used as bulk or coating in propeller shafts,