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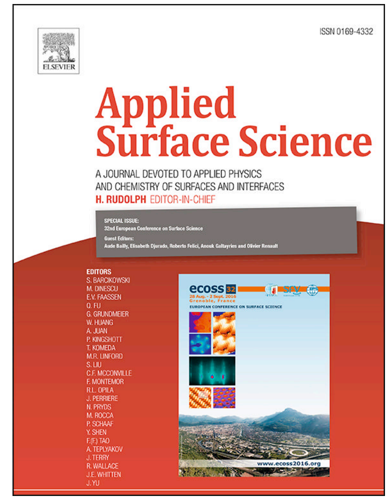

Full Length Article

Effects of deposition angle on synthesis of amorphous carbon nitride thin films prepared by plasma focus device

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Effects of deposition angle on synthesis of amorphous carbon nitride thin films prepared by plasma focus device

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Abstract

Amorphous carbon nitride (a-CNx) thin films were deposited on graphite substrate at different angular positions using a low energy (up to 4.9 kJ) Mather-type plasma focus device. The deposition processes were carried out during 20 focus shots at optimum nitrogen gas pressure of 0.4 mbar. The formation of amorphous carbon nitride was confirmed by Raman Spectroscopy, SEM, EDX, FTIR, and XRD analyses. The intensity ratio of D and G peaks (I_D/I_G) recorded by Raman Spectroscopy showed two distinct trends at various angular positions. The sample deposited at 30 degrees had the highest I_D/I_G ratio and correspondingly the highest sp^3 CH_x content in FTIR spectrum. Samples with lower I_D/I_G ratio appeared with smaller grain size and more smooth surfaces in SEM images. The highest C=N intensities in FTIR spectrum belonged to those samples deposited at 30 and 75 degrees angular positions.

Keywords:

Carbon nitride thin film; Plasma focus device; Graphite substrate; Deposition angle; Raman spectroscopy; Scanning Electron Microscopy; Fourier Transform Infrared Spectroscopy; XRD analysis.

I. Introduction

Carbon nitride thin films, due to their unique properties, are promising candidates for a wide variety of applications. They are used in electrical devices because nitrogen incorporation enhances conductivity [1]. Nitrided carbon thin films, as charge-stripping foils in accelerators, are used for their lifetime and mechanical properties [2]. Carbon nitride coats, due to their low work function, improve electron field emission properties [3]. Wear resistance is another beneficial property of carbon nitride coating. It has been shown that a-CN_x ultra-smooth thin films have better wear resistance compared to amorphous carbon [4]. A mixture of surface nitriding and carbon coating is used to produce anti wear and corrosion magnetic recording media [5]. Exposing the material to nitrogen gas allows the nitrogen to diffuse into the surface and modifies the surface media to have lower coefficient of friction and higher wear resistance. Nitrogen incorporated in the surface improves wear resistance because bonds between nitrogen and carbon increases carbon adhesion with media. Furthermore, a-CN_x stores deformation energy elastically through compression of the inter-planar lattice spacing, while crosslinks