ABSTRACT

Crystalline thin films of carbon nitride are deposited on silicon (100) substrate by ion implantation technique using a 2.3 kJ dense plasma focus device. The energetic ions of carbon and nitrogen strike on the surface of Si(100) and make the bonds with dangling surface of silicon substrate and a crystalline thin film of silicon carbonitride (SiCN) is formed. The samples of Si(100) are exposed to multiple focus shots at an axial position of 9 cm from the tip of the anode, and at different angular positions (0°, 10°, 20°) with respect to the anode axis in order to investigate the angular dependence on the formation of thin films. The exposed samples are characterized using x-ray diffraction (XRD), scanning electron microscopy (SEM), and Raman spectroscopy (RS). The XRD patterns demonstrate the formation of nano-crystalline thin films of SiCN with C_3N_4, Si_3N_4, and SiC phases. Raman spectra demonstrate the disordered (D) and graphite (G) bands showing the formation of carbon nitride films on the silicon (100) substrates. Some bands of silicon nitride and carbon nitride are also identified at different angular positions. The SEM micrographs show the growth of nano-crystalline thin films, which starts to become more prominent as the ion dose is increased. At 0° angular position for 40 focus shots, the surface morphology is tubular and for 10° angular position, thin film with crystals embedded homogeneously shows the two solid solution phenomenon and at 20° angular position, a smooth and nanocrystalline thin film is obtained.