Study of the boron concentration in Boron doped Diamond Films by XPS

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Diamond films with different doping levels (2000, 7000 and 30000 ppm) and different CH_4 concentrations (0.5, 1, 3 and 5%) were grown on titanium substrates in a hot filament chemical vapor deposition reactor. Images obtained by Scanning Electron Microscopy showed continuous microcrystalline and homogeneous films with grain oriented randomly; by increasing the CH_4 concentration the grains start to form agglomerates, reducing the formation of well faceted crystals, this feature has become more apparent in films with a greater concentration of boron. Raman Scattering Spectroscopy confirmed growth of diamond with the characteristic peak located at 1332 cm^{-1} and the doping of film with the appearance of bands at 1220 and 500 cm^{-1}, as well the presence of graphite due to G-band located at 1580 cm^{-1}. High Resolution X-Ray Diffraction was used in grazing mode at three different angles (1, 5 and 30°) to investigate the diamond phases according to the depth of the film examined, it was found one predominant phase (111) of the diamond, and a reduction of substrate phase for higher concentration of CH_4. The samples were also analyzed by X-ray photoelectron spectroscopy (XPS), prior to analysis successive attacks with Argon ion beams were carried out on the sample surface. The results show that as the etching time increases, the peak of the boron becomes more intense, being these more evident in the samples with a higher concentration of CH_4. This is a strong indication that the boron is located in the deepest diamond phases. Further analysis will be done to confirm these observations and to investigate its relationship with the conductivity of the films.

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References:

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