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Detection of nanophase at the surface of HFCVD grown diamond films using surface enhanced Raman spectroscopic technique

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Abstract

Diamond films prepared by hot filament chemical vapour deposition technique were characterised using X-ray diffraction, scanning electron microscopy and surface enhanced Raman spectroscopic technique. Silver was deposited on to diamond thin film under ultra high vacuum conditions and macro-Raman spectra were recorded during the deposition. An asymmetric broadening of the Raman peak at 1332 cm^{-1} and gradual emergence of a new peak at 1240 cm^{-1} with increasing thickness of the silver layer were observed. These observations were explained on the basis of phonon confinement in nanometer-sized crystals. It is proposed that the detected nanophase is present only at the surface and is not a bulk property. The average particle size of the film was estimated from X-ray analysis and also from the symmetric broadening of the 1332 cm^{-1} line in the Raman spectra of the bare sample. The presence of the nanophase was further evidenced by high resolution scanning electron microscopy. The probable mechanism of formation was briefly explored.

Author Keywords: Surface enhanced Raman spectroscopy; Nanocrystalline diamond; X-ray diffraction; High resolution scanning electron microscopy