

Effect of deposition parameters on different stages of diamond deposition in HFCVD technique

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Abstract

The effect of applied bias and system pressure on different stages in the deposition process occurring during diamond deposition on mirror polished Si single crystal substrates in the HFCVD technique has been investigated. For characterization of the deposit, Fourier Transform Infrared Spectroscopy and Laser Raman spectroscopy have been used as the primary techniques while X-ray diffraction and scanning electron microscopy served as supplementary techniques. The findings are that the use of an overall low system pressure \sim 1.3 mbar and application of an appropriate bias to the substrate during the initial stages facilitates the growth of highly oriented cubic silicon carbide film on mirror polished Si single crystal substrates under conditions conventionally used to grow diamond in HFCVD technique. A critical pressure 'regime' \sim 26 mbar has been found to exist during the growth stage for the concurrent growth of SiC and diamond such that only SiC grows below this pressure and diamond starts growing at or above this value. It is suggested that around this transition region, SiC gets partly converted to nanocrystalline diamond structured carbon, which then grows into bigger crystals under appropriate growth conditions.

Author Keywords: HFCVD; Pristine Si single crystal substrate; Different stages of growth; Effect of bias, pressure; SiC; Conversion of SiC to diamond