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The Effect of Ion-Beam Induced Strain on the Nucleation Density of Chemical Vapor Deposited Diamond

P.S. Weiser, S. Prawer, K.W. Nugent, S.P. Dooley and D.N. Jamieson
School of Physics, University of Melbourne, Parkville, Victoria 3052, Australia

In order to investigate the effect of strain on the nucleation density of Chemical Vapor Deposited diamond we have employed high dose Helium and Hydrogen ion implantation producing surface swelling of the substrate. The ion implantation is performed using the Melbourne Microprobe which enables many square regions (typically 100x100 μm^2) to be implanted on the one sample.

The Melbourne Raman Microprobe is employed to obtain spatially resolved strain maps of the laterally confined surface strain in the ion implanted silicon. The surfaces of the "bubbles" are under tensile strain (up to 4.5 GPa) whilst the edges are under compressive strain. Despite the high level of strain the surface of the silicon remains relatively undamaged with the FWHM of the Raman peak virtually unchanged from that of the unimplanted silicon. Thus it is possible to produce undamaged, but very substantially strained surface layers.

The ion implanted samples were immersed in a Chemical Vapor Deposition Reactor and changes in the nucleation density of diamond as a function of surface strain were determined.