

Space charge limited current (SCLC) as observed on diamond surface damaged by MeV ion implantation

H. Wang^{1*}, M. Bruna³, P. Olivero¹, S. Borini³, F. Picollo¹, O. Budnyk¹, F. Bosia², Ž. Pastuović⁴, N. Skukan⁴, M. Jakšić⁴, E. Vittone¹

¹ Experimental Physics Department, NIS Centre of Excellence, INFN Torino – University of Torino (Italy)

² Theoretical Physics Department, University of Torino (Italy)

³ Istituto Nazionale di Ricerca Metrologica (INRiM), Torino (Italy)

⁴ Laboratory for Ion Beam Interaction – Ruđer Bošković Institute, Zagabria (Croatia)

*Correspondence: haowangboiling@gmail.com

Abstract:

Space charge limited currents (SCLC) were observed on diamond surfaces that were damaged by mega-electron volt (MeV) ion implantations. The current-voltage plots display an exponential behavior with a fitting constant α , whose value was found to increase with thermal annealing temperatures up to 600°C. Comparisons among the surface areas implanted with different ion fluences indicate that there exists a damage threshold, above which the SCLC occur, and below which Ohmic conduction dominates. Raman spectroscopy studies confirm that the measured conductance originates from the vacancies created in the shallow surface layers, in agreement with Baskin's model [1]; furthermore, the spectra show that the trapped space charges could be related to the interstitials in the surface layers, which may form a localized field in opposition to the drift current flow.

Key Words: Space charge limited current, MeV ion implantation, Diamond, Vacancies, Interstitials