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Resistant, Sensitive and Fast CVD Diamond Detectors for Intense Ionizing Radiation

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Several medical applications rely on the interaction between high-energy radiation and human tissue. Radiotherapy, radiography, and mammography as well as high-energy physics experiments need a very precise measurement of the radiation dose imparted to the target volume. These techniques differ in the radiation energy content, but all of them require reliable, precise, and sensitive detectors to accurately calibrate the radiation sources and/or directly monitor the dose delivered to a patient.
CVD diamond is a suitable material to be used for intense x-ray and gamma dosimetry since it shows properties of tissue equivalence, radiation hardness and chemical inertness. Such characteristics imply no energy corrections respect to human tissue and advantages of long operative lifetimes.
X-ray diamond dosimeters were assembled by developing injecting diamond-like-carbon/Pt/Au contacts on single-crystal high-purity diamond films with the aim to reduce space-charge effects. Resistivity in the dark of (5.6±0.1)×1014 Ω cm was measured as well as low density deep-states in the band-gap were evaluated from spectrally resolved photoconductivity measurements. Devices resulted to be priming-less with a linearity coefficient to x-ray (Mo-K) dose-rate of 1.02±0.01. Transient x-ray modulated analysis allowed the determination of fast traps influence and an estimation of the dosimeters response times, very fast (10-3 s) at high fields (≥3×10-3 V/cm)

Presenter: Dr TRUCCHI, Daniele M. (CNR-IMIP)

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