Contribution ID: **15** Type: **not specified**

CVD diamond as UV photosensor for two-phase LAr and LXe detectors

Wednesday, 22 May 2013 18:30 (1 minute)

Recent progress in growth of single crystal Chemical Vapour Deposition (CVD) diamonds of very high purity and high homogeneity has opened new perspectives to UV photosensors dedicated to work optically coupled to next generation two-phase liquid-Ar (LAr) and/or liquid-Xe (LXe) detectors for future neutrino and dark matter experiments. These physical investigations require detectors that combine large volume with low energy threshold (down to keV region) and provide efficient background rejection. Useful interactions are followed by UV photons emissions, but only few hundred photons are produced for each interactions and they needs to be collected with high efficiency. CVD diamond shows excellent performances in UV and X-ray detection, its chemical inertness and mechanical robustness make them most suitable to operate in hash environment. Diamond detectors are blind to visible light and this property greatly help reducing one of the most disturbing source of background. Investigations done by SEM-EDS in order to measure the quantity and kind of impurities inside diamond lattice are presented and discussed, showing how persistent photoconductivity and undesirable pumping effects can be significantly reduced smashing down the impurity and point defects concentration in the lattice. The response time, the photosensivity and the signal to noise ratio results greatly improved, I-V, visible blindness and dark current measurements are reported. CVD diamond spectral response was characterized in the 190-400 nm range, the highest current sensitivity is achieved at 225 nm, the photopeak response at 225 nm is higher than four order of magnitude with respect to photocurrent measured at wavelength just before 400 nm and a very sharp photocurrent drop is observe just after 245 nm. The response of CVD diamonds as UV sensors suggests that they could be considered as suitable candidates for neutrino and/or dark matter applications.

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Session Classification: Poster Session