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Diamond detectors with 3D graphitic electrodes for medical small field dosimetry

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Thanks to new emerging technology, diamond devices with 3-dimensional structures are produced by using laser pulses to create graphitic paths in the diamond bulk. The fabrication of very narrow and close by columnar electrodes perpendicular to the detector surface allows the employment of a lower bias voltage at which the saturation charge velocity is reached and faster detector response, due to the decreased distance between the electrodes, compared to a diamond standard planar geometry detector. Also due to the much shorter electrodes distance, the 3D diamond detector charge collection efficiency is less deteriorated by the radiation damage of the diamond material. On the other hand, diamond tissue-equivalence, high radiation sensitivity and high resistance to radiation damage make it a good candidate for high precision measurement of the doses released during medical radiation therapy. The aim is the realization of an all-carbon device in order to measure the photon beam delivered dose without applying any correction factor due to the absence of metal electrodes. We will report the realization and characterization of the integrated graphitic electrodes on the diamond in order to obtain low resistivity electrodes and the direct bonding on graphite to avoid metal contacts for precise medical dosimetry.

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