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CVD Diamond for Ionising Radiation Detection and Concentrated Solar Radiation Conversion

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During the last decade, CVD diamond demonstrated the potential to overcome limitations connected to the use of natural diamond stones, by ensuring minor production costs and reproducible physical properties. Many research groups reported results on polycrystalline diamond films as a sensitive material to ionizing radiation, but problems of signal stability and material homogeneity hampered the transition from a research to a production level. The relatively recent technological advances in CVD diamond homoepitaxy allowed single-crystal films becoming a standard material, with physical properties even superior than natural diamond. The scientific and technological challenge is now focused, at an industrial level, on the control of the films defect density and, at a R&D level, on developing device structures able to maximize the performance of the specific device designed for each specific application. We report on the development of x-ray dosimeters and fast neutron spectrometers characterized by performance superior than the commercial ones.
On the other hand, polycrystalline diamond still acquired additional interest for large area applications. Owing to its electron emission capability connected to conditions of negative electron affinity, polycrystalline CVD diamond was employed as an efficient thermionic emitter in a novel-concept conversion module for concentrated solar systems. We report on the tailoring of the physical properties of CVD diamond films acting as pure thermionic emitters as well as photon-enhanced thermionic cathodes.

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