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Short_Oral_48: CVD diamond detectors for VUV and SX-ray fusion plasma diagnostics

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Diamond is a semiconducting material widely used in technological applications where extreme operating conditions are required: its outstanding physical and electrical properties (high band-gap, high thermal conductivity, high radiation hardness, high charge carrier mobility, visible-band radiation blindness) make feasible the realization of fast, low noise and well performing radiation detectors suited to withstand environments characterised by high temperatures and high radiation fluxes like those found in thermonuclear fusion experiments. In view of the above, diamond detectors appear to be especially promising for VUV and Soft X-ray (SX) radiation detection and two of them were successfully installed on JET since 2007 [1].
We report on the performances of two Chemical Vapor Deposition (CVD) single crystal diamond-based detectors installed in one of the equatorial ports of the FTU tokamak during the last two experimental campaigns of the machine. The devices were developed by University of Rome "Tor Vergata"and they are Schottky photodiodes with a metal/intrinsic/p-type diamond layered structure; their responsivity curves (A/W vs incident photon energy) were calculated from tabulated atomic scattering factors [2]. The diamond detectors were placed in the machine high vacuum and they were operated in current mode using low-noise preamplifiers.
Several examples of plasma events have been collected, confirming the fast response capabilities of diamond detectors. The so-called Anomalous Doppler Instabilities were observed and there are interesting results related to the pellet ablation during a SPI. Diamond detectors often but not always followed the MHD activity, depending on its localization relative to the emitting region. Core temperature oscillations following ECH modulation were also observed. The comparison of the diamond signals was extended to selected channels of the FTU bolometry system [3] with similar line-of-sight and the encouraging results have launched an R&D program for the development of diamond-based bolometers.
[1] M. Angelone et al., Nucl. Instrum. and Methods A 623, 726 (2010)
[2] B. L. Henke, E. M. Gullikson and J.C. Davis, Atomic data and nuclear data tables 54(2), 181 (1993)
[3] L. Di Matteo, Technical Report RT_2009-38-ENEA, 2009

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