Characterization and TCAD modelling of diamond Schottky barrier diodes as test structures for the development of a high-power electronics technology

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Pseudo-vertical Schottky barrier diodes have been fabricated on Boron-doped diamond layers grown by MPCVD (micro-wave plasma enhanced chemical vapor deposition) on HPHT (high-pressure high-temperature) and CVD substrates. Diodes have different sizes and different metal-to-mesa spacings, to allow perimeter and electric field effects to be analyzed. In this study, results are shown from the extensive characterization of these devices by a coupled experimental/simulation approach, allowing the different operational regimes to be linked to technology-specific parameters for both forward and reverse bias. Effective (N_A-N_D) doping concentration profiles are extracted from quasi-static C-V measurements. Charge trapping effects are investigated by capacitance DLTS measurements. Reverse breakdown is analyzed both experimentally and by means of simulations. The latter also allow to explore viable optimization routes towards the exploitation of the present technology for the fabrication of high voltage diamond diodes and transistors.

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