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The 2019 MRS Fall Meeting was held December 1 – December 6, 2019, in Boston, Massachusetts, at the Hynes Convention Center and adjacent Sheraton Boston Hotel.

The world's foremost international scientific gathering for materials research, the MRS meeting showcases leading interdisciplinary research in both fundamental and applied areas presented by scientists from around the world.

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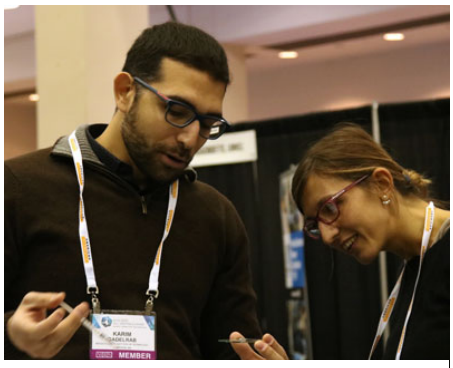

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MRS Meeting Scene

9:45 AM - EL05.09.07

Experimental and Modelled I-V Characteristics of Boron-Doped Diamond at High Electric Fields Including Self-Heating Effect

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Hide Abstract

Diamond is a wide band gap semiconductor with high thermal conductivity, carrier mobility and breakdown field, which make it particularly suitable for the fabrication of high power electronic devices. However, the development of diamond devices is limited by the high ionization energy of its dopants, which leads to only a small fraction of them being ionized at room temperature. When stressed by a high electric field, a current multiplication has been observed in boron-doped diamond (BDD) attributed to Impurity Impact Ionization (III) and the ionization of the neutral acceptors[1]. In this work, we analyse the current multiplication in BDD including the combined effects of Self-Heating (S-H) and III.

Epitaxial BDD layers with different acceptor concentrations in 3.1×10^{18}—6.1×10^{19} cm^{-3} range have been grown in an AX5010 microwave plasma enhanced chemical vapour deposition system. Quasi-static current-voltage (IV) characteristics were measured using a Transmission-Line Pulse setup[2] with 100 ns pulse duration on concentric titanium/gold ring-disk electrodes structures patterned by standard lithography and wet etching methods. S-H was analysed using Transient Interferometric Mapping (TIM)[3] of the thermal energy distribution between electrodes in ns time scale. The experimental IV characteristics were modelled by taking into account S-H effect and III using finite element method. The simulated IV characteristic, in particular the negative differential resistance (NDR) region appearing due to S-H effect, is in good agreement with the experimental data. This work was financially supported by the project 17-05259 S of Czech Science Foundation and the SGS Student Grant "Electric Discharges II: experimental research, modeling and applications" ID: SGS19/167/OHK3/3T/13.

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