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DIAMOND AS POWER DEVICE

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ABSTRACT- Different types of diamond field effect transistor (FET) devices were explored such as hydrogen terminated diamond FETs. Simulation via ATLAS Silvaco was implemented using a model that induces two dimensional hole gas (2DHG) with the method of fixed charge placement on the aluminum oxide (Al_2O_3) and diamond interface instead of acceptor placement. Current advancements of diamond devices simulation, a diamond surface channel type Metal-Semiconductor Field-Effect-Transistors (MESFET) was introduced which acceptors are distributed two dimensionally on the diamond surface. On the other hand, our model structure is similar as the polarization charges generated at the AlGaN/GaN interface in AlGaN/GaN HEMT. In this simulation, Al_2O_3 band gap was set to be 6.5 eV, diamond band gap was set 5.5 eV and band offset is 3 eV. The structure of these devices consists of three terminals; the source, the drain and the gate terminals. Intended for comparisons with previous experimental findings, similar gate drain length (LGD) devices of 17 µm were selected. Simulations were carried out using ranges similar as per experimental parameters of V_G = -10 V to 6 V with 4 V steps, V_G = -50 V to 50 V with 20 V steps and VG = -60 V to 20 V with 20 V steps for black polycrystalline diamond, Transparent polycyrstalline diamond and Heteroepitaxial diamond respectively.

Keywords: diamond, power device, polycrystalline, heteroepitaxial.