Reconfigurable metal-insulator-graphene varactors/rectifiers

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Metal-insulator-graphene (MIG) diodes show promising rectifying figures of merit (FoMs) in terms of current density, asymmetry, nonlinearity, and responsivity thanks to the graphene work-function tunability that can be exploited to modify the electrical injection over the MIG insulator barrier [1], [2]. In this way, MIG rectifiers have already outperform conventional metal-insulator-metal (MIM) technologies in nonlinear applications such as power detectors and mixers [3].

In contrast, the bias-controlled quantum capacitance (also enabled by the zero bandgap and finite density of states of graphene) can be utilized to tune the overall MIG structure capacitance, allowing it to operate as an ambipolar varactor [4]. This has been demonstrated very relevant for high-frequency linear applications such as e.g. phase-shifters [5].

In this work we show the fabrication, comprehensive characterization (Fig. 1) and compact-model fitting of the J-V and C-V characteristic of MIG diodes and project their prospect reconfigurable operation as rectifiers or varactors as a function of the operating frequency for a given bias point.

References

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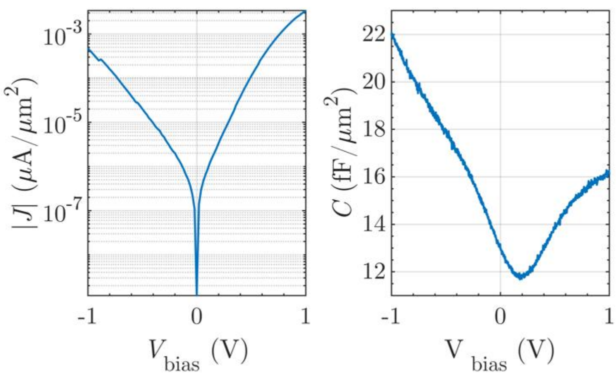
Figures



a) b)

Figure 1: a) J-V, and b) C-V of the measured device.

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