Physical model and parameters for graphane bipolar junction transistors

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Abstract
The celebrated monolayer graphene, as a gapless semimetal, may be hydrogenated to obtain a semiconductor with an energy gap, named graphane. The planar arrangement and unique physical and electronic transport features of graphene, combined with the possibility of doping graphane, allows patterning and creation of p and n regions, in such a way that two-dimensional p-n rectifying junctions become practicable. Our recent analyses reveal that ideal I-V characteristics for such junctions may be expected [1]. Based on the theoretical model of planar graphane diodes developed in our earlier works, here we construct a physical model to predict the behaviour of bipolar junction transistors based on graphane. We derive the small-signal equivalent model and estimate the performance of the device.

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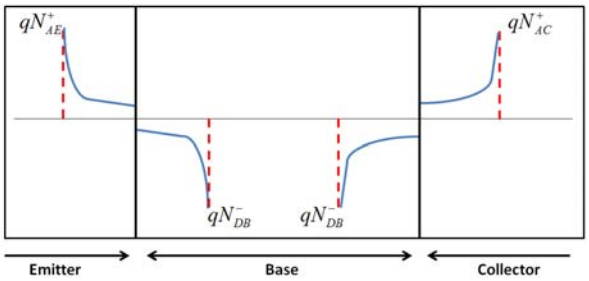

Fig. 1. Depletion charge distribution in the n-p-n transistor.

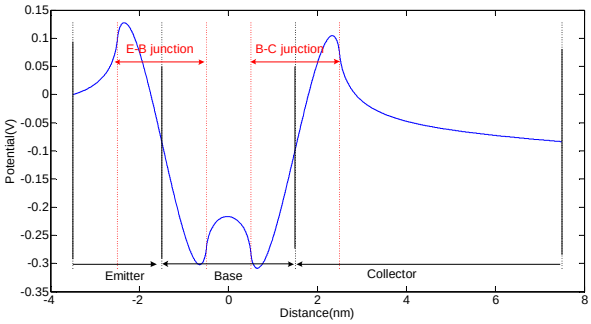

Fig. 2. Electric field distribution of the n-p-n transistor.

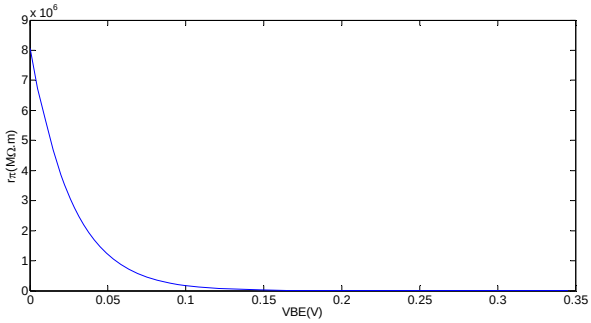

Fig. 3. Voltage dependence of the input resistance.

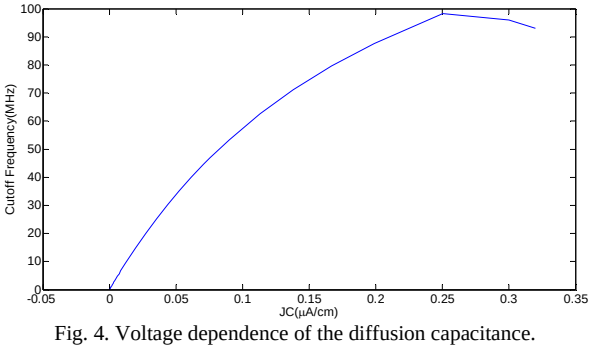

Fig. 4. Voltage dependence of the diffusion capacitance.