Graphene Field-Effect Transistors with Velocity Saturation

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Current saturation is a valuable alternative of bandgap engineering to achieve high-gain graphene field effect transistors (GFETs) for RF applications. One way to face this challenge is to use the hyperbolic phonon polariton scattering mechanism that occurs in graphene supported on boron nitride (hBN) substrate [1]. Here, we present measurement and modelling of DC and RF performances of bottom-gated, h-BN supported, RF-GFET (figure 1) operating in such a velocity saturation regime [2]. We account for Dirac pinch-off and supercollision cooling mechanisms [3]. We demonstrate a maximum oscillation frequency exceeding 20 GHz [2] and show that this technology reaches the desired $f_{max} \geq f_T$ regime (figure 2). We anticipate the possibility of $f_{max} \geq 100\ GHz$ with an optimized design and operating bias conditions. We also envision new perspectives "beyond GFETs" using plasma resonance devices [4] highly suitable for RADARs and GSM applications operating in the sub THz domain.

References

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Figures

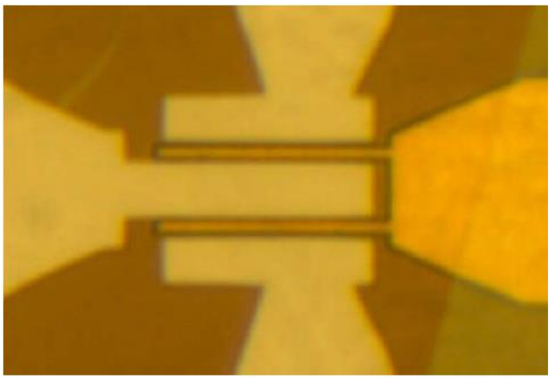

Figure 1: Optical image of the RF GFET on h-BN with buried bottom gates.

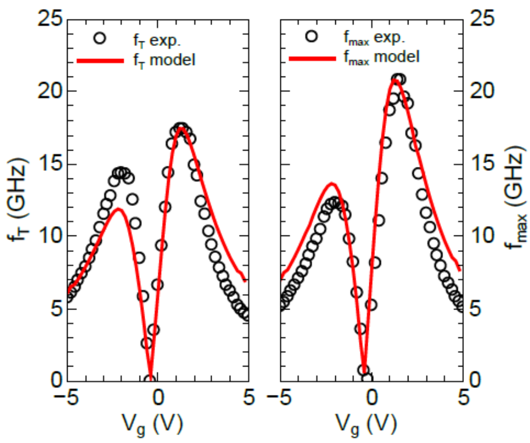

Figure 2: Cut-off frequencies (circles) together with the model prediction (Lines) [2].