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BN / Graphene / BN RF Transistors HAN WANG, MIT, THITI TAYCHATANAPAT, Harvard University, ALLEN HSU, PABLO JARILLO-HERRERO, TOMAS PALACIOS, MIT — In this work we demonstrate the first BN/graphene/BN transistor for high frequency RF applications. This sandwich structure allows a significant improvement in the mobility of graphene, which reaches more than 18,000 cm^2/Vs at room temperature. Graphene field effect transistors (GFETs) have been fabricated with L_{DS}= 800 nm and L_G=300 nm. The minimum conduction point of these devices is very close to zero, a result of the negligible substrate doping to the graphene. A current density in excess of 1 A/mm and DC transconductance above 200 mS/mm are achieved for both electron and hole conductions. RF characterization is performed for the first time on this device structure and initial results show a current-gain cut-off frequency f_T=10 GHz. These experimental results have been combined with simulations of the small-signal model to study the scaling potential of these GFETs for high frequency applications. The impact of the access resistances (R_s, R_d), the capacitances (C_{gs}, C_{gd}, C_{ds}), and the transconductance (g_m) on the frequency performance of the GFETs has also been studied. Finally, the fabricated devices have been compared to GFETs fabricated with SiO_2 substrate and Al_2O_3 gate dielectrics. The improved performance obtained by the BN/graphene/BN structure is very promising to enable the next generation of high frequency RF electronics.

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