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Effect of back-gate bias on Graphene RF device performance
WENJUAN ZHU, DAMON FARMER, YANQING WU, BRUCE EK, KEITH JENKINS, PHAEDON AVOURIS, IBM T.J. Watson Research Center — Graphene is very promising for RF devices due to its high carrier mobility. High cut-off frequency graphene RF devices using CVD grown graphene and epitaxially grown graphene have been reported. Here we report the effect of the back-gate bias on the FET cut-off frequency and current saturation. We found that there are two peak cut-off frequencies corresponding to electron peak trans-conductance and hole peak trans-conductance maxima respectively, as we sweep the top-gate bias. The electron peak cut-off frequency can be significantly increased by applying a positive back-gate bias. The higher the voltage, the larger the maximum cut-off frequency. This can be explained by the additional electron doping introduced by the back-gate bias in the under-lap region, which forms an n-n+-n configuration. Similarly, the hole peak cut-off frequency can be significantly enhanced by applying negative back-gate bias to form the p-p+-p configuration. The shorter the channel, the more pronounced this effect. We also found that the current saturation is also improved by introducing the same type of carrier as the channel in the under-lap region.

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