Small Gate Length Microwave Graphene Transistor on Kapton Substrate

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Abstract Graphene is a promising material for flexible transistors [1,2,3]. It has ambipolar carriers with high mobility, high saturation velocity and is very flexible and mechanically strong [4,5]. In this work we report the development and full characterization of graphene field-effect transistors (GFETs) on Kapton substrate. The developed process is based on a low-temperature technology utilizing an Aluminum bottom gate with a natural oxide on top. The chemical vapor deposition (CVD) graphene (2×2 cm^2) is provided by Graphenea, and shows hole mobility of 2500 cm^2/Vs at concentration of 2.7×10^{12} cm^2 which are both extracted from Hall measurement. A large number of transistors have been successfully fabricated on Kapton. The gate length is decreased from 300 nm to 100 nm, combining with different channel width (from 12 µm to 50 µm). To our knowledge, flexible graphene transistor with gate length of 100 nm has not been reported before. For device characterization, we report current gain cut-off frequency (f_t) of 39 GHz and maximum oscillation frequency (f_{max}) of 13.5 GHz, deduced from the S-parameters measurements. These performances are as-measured results, without de-embedding, and correspond to the state of the art for flexible GFETs. Additionally, mechanical study shows the robustness of our devices, which have little performance variation (<10%) under strain value up to 0.5%. This study demonstrate the potential of our fabrication process for robust high performance flexible GFETs.

References

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