Lightwave electronic in Graphene

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A new cross-disciplinary field of research combines 2D materials, electronics, and photonics to create faster, more powerful nanoscale-integrated devices that use less energy. Previous studies have shown that powerful light pulses can create and manipulate rapid transition currents through solid electrical fields[1,2]. Other studies recently revealed current tunneling across a thin hexa-boron Nitride (hBN) insulator barrier encapsulated with two monolayer Graphene[3]. Given the aforementioned circumstances, a question arises: what would be the outcome if a Graphene channel and a Graphite floating gate were positioned apart by a slender layer of hBN while subjected to a potent electric field generated by a high-intensity laser pulse? In our pursuit of addressing the inquiry, we have conducted thorough research. However, as of the present moment, there is a deficiency in interpreting the subject matter. This work presents a novel finding in the realm of Lightwave electronics, wherein we integrate cutting-edge nanofabrication techniques to develop a distinctive Graphene Floating gate – Field Emission Transistor (FG - FET). Additionally, we employ high-intensity broadband THz technology to create a low-energy memory Graphene device foundation for future applications. In our study, we have observed an unusual phenomenon when the samples are irradiated under THz pulses, also, the electrical result before and after the samples interacted with THz pulse suggests a significant amount of have been transferred and trapped into the floating gate layer and discharge slowly over time. This could pave the way for the new future electronic storage devices.

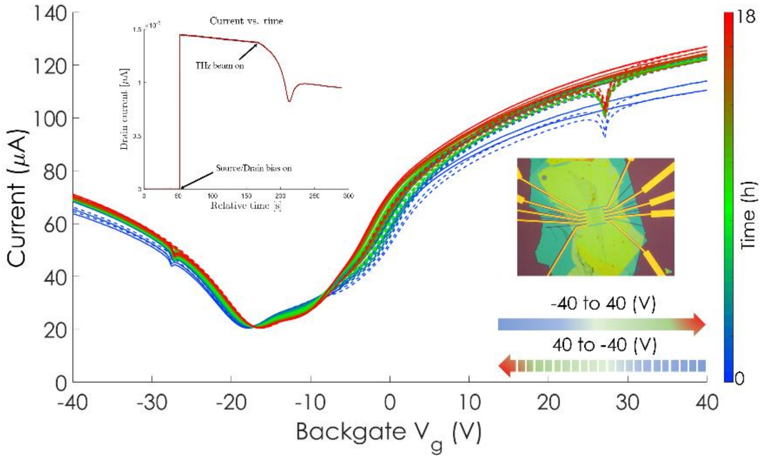

Figure 1: Drain current vs gate voltage at different ranges of V_g, V_d = 50 (mV)

References

[1] T.Higuchi, C.Heide, K.Ulmann, H.B.Weber, & P.Hemmelhoff, "Light-filed-driven currents in graphene",Nature, 550, 7675 (2017)

[2] Schelecht et al., Sci. Adv.8, eabj5014 (2022)

[3] Deepika Yadav et al (2016) 2D Mater. 3 045009