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Integrated graphene based modulators enabled by interfacing plasmonic slot and silicon waveguides

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Graphene has offered a new paradigm for extremely fast and active optoelectronic devices due to its unique electronic and optical properties [1]. With the combination of high-index dielectric waveguides/resonators, several integrated graphene-based optical modulators have already been demonstrated [2,3]. However, the optical modes in these systems are inherently strongly localized in the high-index materials, thus jeopardizing light-graphene interactions.

Surface plasmon polaritons have been shown the ability to manipulate light in the nanoscale, while at the same time giving possibility to direct more optical energy to the material interface where graphene could reside. We propose and demonstrate efficient graphene plasmonic waveguide electro-optical modulators, which are fully integrated with the silicon-on-insulator platform. We experimentally achieve the tunability of 0.13 dB/μm for the graphene plasmonic modulator [4], which exceeds the performance of previously reported graphene-plasmonic modulators.

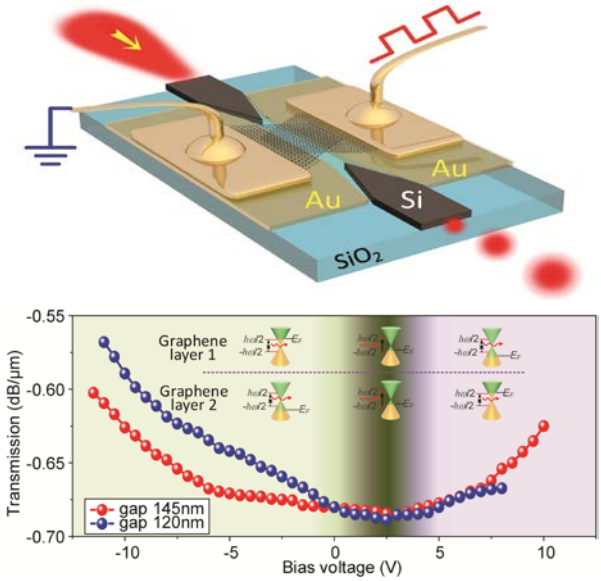

Figure 1. Upper: 3D schematic of the graphene plasmonic waveguide modulator. Down: Modulated transmission for 20um-long graphene plasmonic hybrid slot waveguides.

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