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Graphene-based electro-optical modulators operating at telecommunication wavelength range

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Compact and fast optical modulators with low operating voltage and low power consumption are in great demand by the telecommunication industry. The task of creating such modulators can be addressed using the unique optical and electronic properties of graphene. A staunch progress have been recently made in designing hybrid graphene-based modulators working at telecommunication wavelength range where graphene is combined with various optical heterostructures, waveguides, interferometers and graphene gating is used as a method of electro-optical control. High frequency operation and reasonable large modulation depth have been demonstrated. However, devices which combine all important ingredients (compactness, speed, low operating voltage and low power consumption) are still lacking. Here the aim of our investigation is simple graphene-based telecommunication electro-optical modulators fabrication which guarantee extremely small modulation volume ($<\lambda^3$), work at low gating voltages (~1V), have low power consumption (<1 μW) and show modulation depth (~4%) using a single layer of graphene. We discuss various technological aspects necessary to achieve these parameters including the problems of graphene transfer, gating along with the choice of the optimal parameters for the optical heterostructures and provide the results of electrical and optical characterization of the devices. The novelty of our approach lies in careful choice of high quality graphene monolayer and implementation of a high-k-gate dielectric which give the possibility to apply small gate biases and obtain significant electro optical modulation effect. We believe that our devices (being easily integrable into any optical scheme) could find wide range of applications in the telecommunication industry.

Biography

D E Aznakayeva is a 3rd year PhD student in Condense Matter Physics Group at the University of Manchester, UK. She has 43 scientific papers. Her research areas are smart materials, graphene based nanoplasmonics, metamaterials and nano electro-optical devices computation, fabrication and characterization.

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