Adaptive Graphene-Based Electro-Optical Modulator

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Abstract

This study introduces an adaptive modulator for multilevel amplitude modulation utilizing graphene-based capacitive segments integrated over planar waveguides. In the initial investigation [1], three novel graphene-based capacitor-like segments are integrated into a silicon platform, forming an optical digital-analog converter. This converter facilitates the generation of symmetric multilevel PAM-4 coding transmissions with a highly compact layout. In the subsequent study [2], we present a dynamic configuration of the modulation scheme, transitioning between PAM-4 and PAM-8, achieved through a sequenced application of logic voltages. The combination of an innovative design and the unique electro-optical characteristics exhibited by the materials in the proposed adaptive device shows a potential contributor to silicon or polymer integration, addressing high-performance communication requirements.

References

[1] M. M. de Carvalho, E. A. Thoroh de Souza, L. A. M. Saito, "Graphene-based PAM-4 modulator compatible with CMOS platform operating over DWDM C-Band" Results in Optics 5, 100110 (2021).
[2] W. A. Camacho, M. M. de Carvalho, J. C. Ramirez, E. A. Thoroh de Souza, L. A. M. Saito, "Adaptive PAM-4/PAM-8 graphene-based electro-optical modulator integrated into a Polymer waveguide platform for data-center communication" Optics and Laser Technology 157, 108622 (2023).

Figures

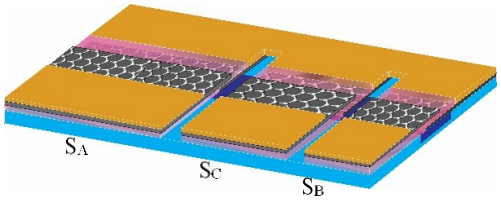

Figure 1: Schematic of PAM-4 graphene-based modulator with three segments [1].

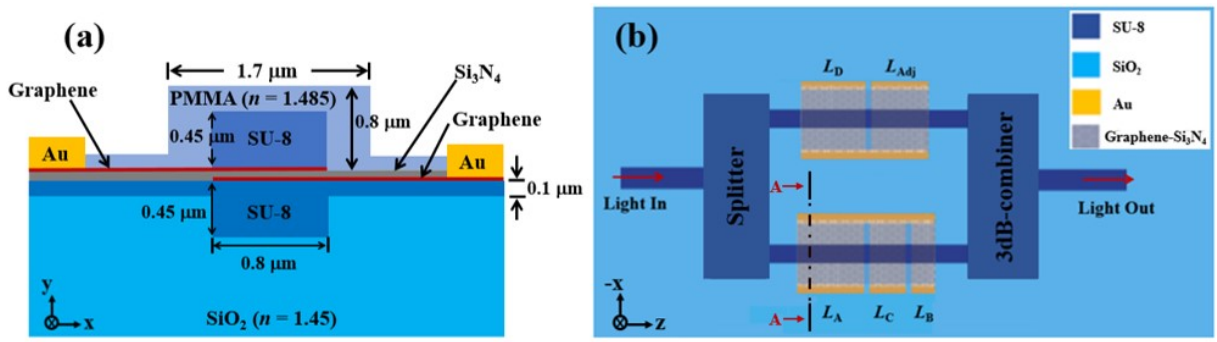

Figure 2: Adaptive PAM-4/8 modulator in a polymer waveguide. (a) AA cross-section of graphene-based modulator integrated with SU-8 waveguides. (b) 1st arm: PAM-8 eye symmetry adjustment with segments L_{Adj} and L_D. 2nd arm: PAM-4 modulator composed of L_A, L_B, and L_C [2].