120Gb/s ultra-fast photo-thermo-electric graphene photodetector for optical communications

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Abstract

The development of new photonic integrated modules for telecom and datacom applications must fulfill severe requirements in terms of bandwidth increase, foot-print and power consumption [1][2]. Graphene, a carbon allotrope and 2D material, due to its broadband optical absorption [3], the large mobility[4], and the short carrier relaxation times [5], has been recently proposed as a potential candidate for integration with Silicon Photonics [6] to reach these objectives.

High speed photodetectors are essential building blocks in an optical communication system [7]. Ultrafast graphene photodetectors reported so far, able to detect an optical data stream, use the photo-bolometric and the photo-conductive effect which suffer a large (~mA) dark current [8].

Here we report on a graphene photodetector, integrated on a Silicon-on-Insulator (SOI) waveguide, based on the photo-thermoelectric effect (PTE) and operating with zero dark current. The device is fabricated using Chemical Vapour Deposition (CVD) graphene. Thanks to an optimized design, we demonstrate for the first time, to the best of our knowledge, the detection of an optical data transmission at a bit rate equal to 105 Gb/s using a Non-Return-To-Zero On-Off-Keying (NRZ OOK) modulation format and equal to 120 Gb/s using a 4 level Pulse-Amplitude-Modulation (PAM4) format.

References

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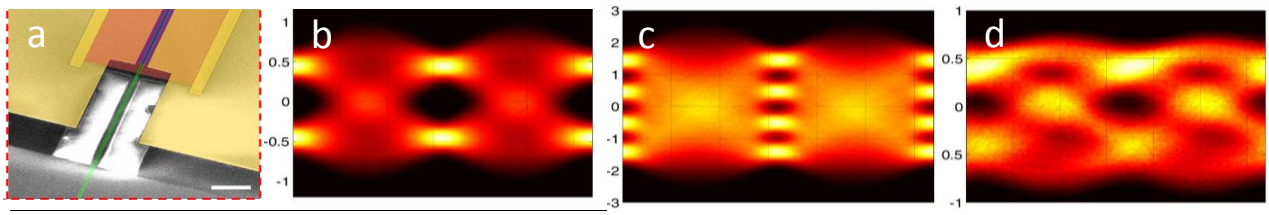

Figure

Figure: a) False color SEM image of the device. Collected eye diagrams for the 60 Gb/s NRZ (b), 120 Gb/s PAM 4 (c) and 105 Gb/s (NRZ) modulation format.