

Supplementary Material

High Gain and Broadband Absorption Graphene Photodetector Decorated with Bi₂Te₃ Nanowires

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1. SEM Image of Bi₂Te₃ Nanowires (NWs) Used in this Work

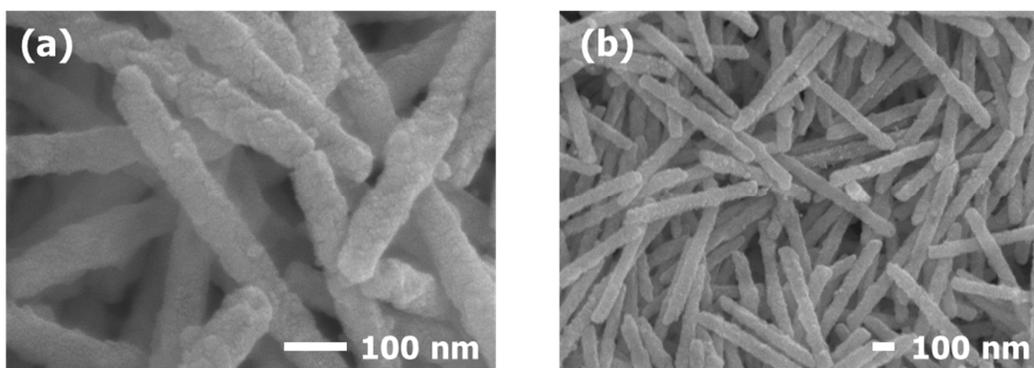


Figure 1. SEM image of Bi₂Te₃ nanowires on a substrate. (a) $\times 150,000$ and (b) $\times 50,000$ magnification SEM image of Bi₂Te₃ nanowires .

The average length of Bi₂Te₃ NWs is ~ 611.2 nm and the diameter is ~ 67.3 nm. The standard deviation of length and diameter size of 36.01 nm and 6.58 nm, respectively. Those numbers were characterized based on the SEM image of Bi₂Te₃ NWs on the SiO₂/Si substrate.

2. Carrier Lifetime Extraction Using Monochromatic System

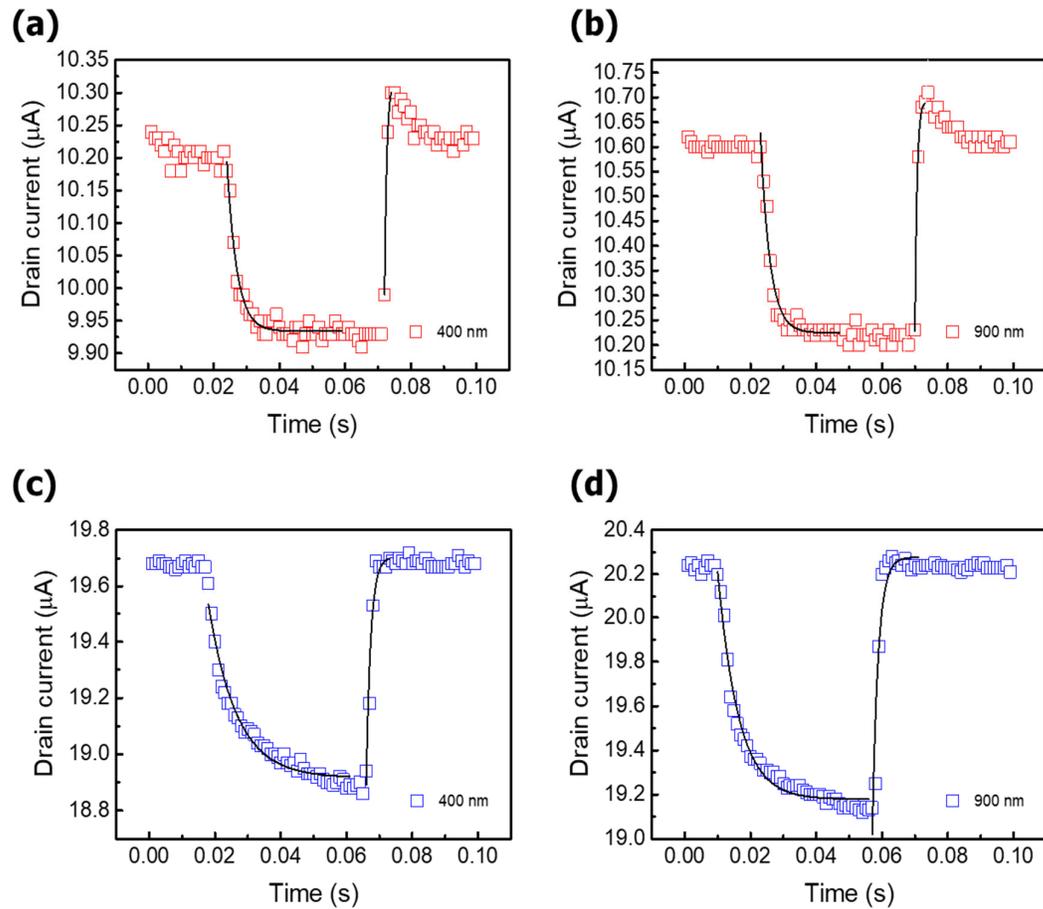


Figure S2. Carrier lifetime extraction for each wavelength. The carrier lifetime of the graphene photodetector was extracted with the result of transient photocurrent measurement, the on-off frequency was 10 Hz. (a) and (b) are time – photocurrent illumination result of graphene photodetector of 400 and 900 nm, res. (c) and (d) are illumination result of Bi₂Te₃ nanowires decorated graphene devices of 400 and 900 nm, respectively.

3. Time-Photocurrent Characterization under 2200 nm Wavelength Illumination

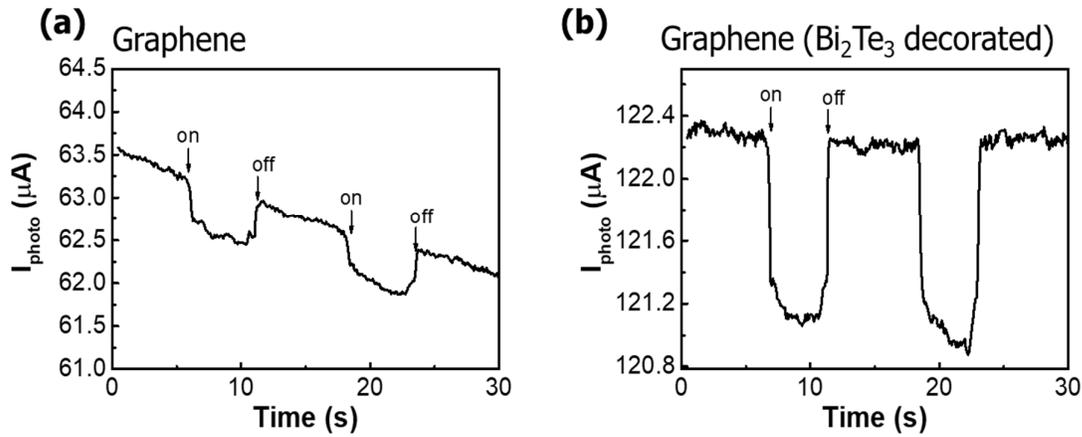


Figure 3. Time-photocurrent characterization under 2200 nm illumination. (a) graphene channel device, (b) graphene channel device decorated with Bi_2Te_3 nanowires.

Time-photocurrent characterization with 0.1 V operation condition. The period of on-off is 10 s and tried until 30 s. In graphene photodetector, there are unstable drain current degradations during the on-off cycle, and the level of drain current is two times lower compared to Bi_2Te_3 nanowire doped photodetector. In case of Bi_2Te_3 decorated graphene photodetector, it showed stable drain current level before and after on-off cycle test.