Wearable Rolled Graphene/Perovskite Fiber Photodetectors

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The integration of optoelectronic devices such as photodetectors (PDs) into the wearable platforms is of great interest for applications like healthcare (monitoring heart rate) [1] or physiological monitoring [2]). A growing body of research has aimed at integrating rigid components (i.e. silicon-based electronics) within flexible systems (i.e. textiles) [3]. However, developing flexible integrated wearable systems adaptable to mechanical stress caused by body motions is desired [4]. We report a process for the fabrication of fiber PDs comprising rolled chemical vapour deposited single layer graphene (SLG) and photoactive perovskites, Fig1. Conductive fibers (~200 Ω/cm) are made by rolling SLG around individual silica fibers. This is followed by the deposition of a dielectric layer (Al_2O_3 and Parylene C), another rolled SLG as the channel, and perovskite as the photoactive component. The devices exhibit temporal response time (response speed to the modulation frequency of incident light) ~5ms and external responsivity (ratio of photocurrent to incident optical power) ~22kA/W at an operating voltage of 1V. The results exceed previously reported fiber-based PDs by over five orders of magnitude [7,8]. The device exhibits over 40 cycles endurance, with<10% degradation in external responsivity. Washability tests (20 cycles) according to the AATCC (American Association of Textile Chemists and Colorists) [9] standard shows~10% degradation in external responsivity, twice that of semiconductor diodes integrated into fiber [2].

References

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Figures

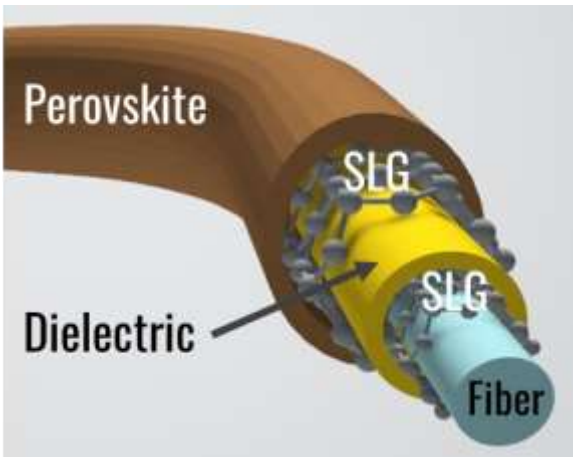

Figure 1: Schematic drawing of the fiber-based SLG-PVK PD.