Self-Powered NIR Photodetectors for Health Care Monitoring

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Abstract: Wearable healthcare devices have disrupted health monitoring with personalized medical diagnostics and real-time data collection. An essential component of such devices are high-performance near-infrared (NIR) photodetectors, which facilitate the non-invasive measurement of vital signs and physiological parameters such as blood oxygenation, heart rate, and pulse rate[1-4]. Significant progress has been made in exploring functional materials for self-powered NIR photodetectors on rigid substrates. However, the development of flexible self-powered NIR photodetectors and their integration into wearable device applications are largely overlooked in the literature. we aim to develop efficient and stable flexible NIR photodetectors operating in self-powered mode (or zero bias) based on non-toxic and cost-effective semiconductors tailored for seamless integration into wearable healthcare devices. We will leverage eco-friendly tin-based perovskite-inspired materials (PIMs), starting from A_2SnI_6 and $Sn_2SbS_2I_3$, owing to their broadband photodetection from UV-visible-NIR regions, good air stability, and low-temperature solution processing (Figures 1(a-c)). The mechanical flexibility of photodetectors is a paramount feature, enabling seamless adherence to various surfaces and conforming to the dynamic movements of the human body. The performance of NIR photodetectors will be enhanced by understanding the defect chemistry of PIMs, the charge transport within the device components. The reliability of the photodetectors will be verified in different conditions (environmental, thermal, and mechanical) and will be improved by reducing the ion migration and device engineering approaches. Finally, we would like to test these devices for real time applications (Figure 1d).

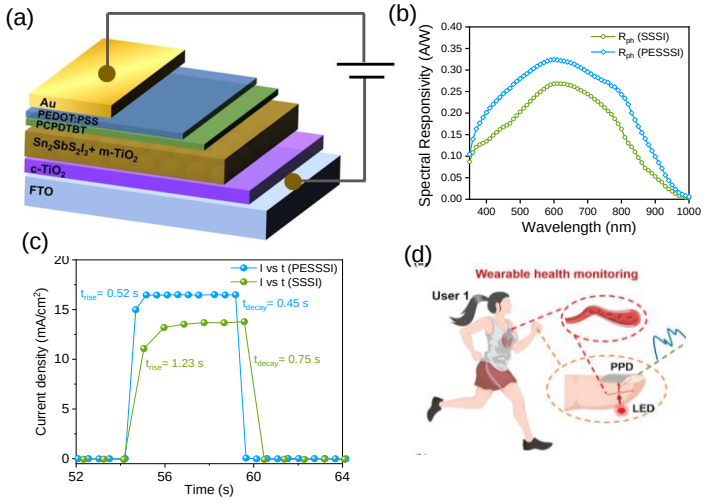

Figure1: Device schematic of NIR self-powered photodetector and their characteristics and possible applications

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