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Flexible and Broadband Photodetectors via Solution Processed Antimony Selenide EBUKA ARINZE, Johns Hopkins Univ, MD REZAUL HASAN, ARUNIMA SINGH, VLADIMIR OLESHKO, SHIQI QUO, ASHA RANI, IRINA KALISH, NIST, YAN CHENG, Johns Hopkins Univ, MONA ZAGHLOUL, GWU, MULPURI RAO, GMU, NHAN NGUYEN, ABHISHEK MOTAYED, ALBERT DAVYDOV, RATAN DEBNATH, NIST, SUSANNA THON, Johns Hopkins Univ — The demand for high-performing low-cost broadband photon detection has generated interest in new materials that couple high absorption with traditional electronic infrastructure (CMOS) compatibility. In this study, we demonstrate a facile, low-cost and scalable, catalyst-free one-step solution-processed approach to grow one-dimensional Sb_2Se_3 nanostructures directly on flexible substrates for high-performing near infrared (NIR) photodetectors. Structural characterization and compositional analyses reveal high-quality single-crystalline nanowires with orthorhombic crystal structure and a near-stoichiometric atomic ratio of antimony to selenium (Sb: Se). A measured direct band gap of 1.12 eV is consistent with predictions from theoretical simulations, indicating strong NIR potential. Metal-semiconductor-metal photodetectors fabricated from this material exhibit fast response (on the order of milliseconds), high performance (responsivity ˜0.27 A/W), outstanding mechanical flexibility, and structural durability. The experimental results demonstrate the potential of solution-processed Sb_2Se_3 nanostructures in flexible and broadband optoelectronic devices.

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