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Enhanced performance in SnO_2 thin film UV photodetectors via self-assembled CuO/SnO_2 nanoheterojunctions BOTONG QIU, Johns Hopkins Univ, TING XIE, MD HASAN, National Institute of Standards and Technology, EBUKA ARINZE, Johns Hopkins Univ, NHAN NGUYEN, ABHISHEK MOTAYED, National Institute of Standards and Technology, SUSANNA THON, Johns Hopkins Univ, RATAN DEBNATH, National Institute of Standards and Technology — Low-cost visible-blind ultraviolet (UV) photodetectors (PDs) are of interest for versatile applications in digital imaging, optical communications, and biomedical sensing. We report on the use of CuO/SnO_2 $p-n$ nanoscale heterojunctions to enhance the performance of SnO_2 thin film UV PDs. Our method produces robust structures that operate at low bias without complex fabrication processes. The nanoheterojunctions are self-assembled by sputtering Cu clusters that oxidize in ambient to form CuO nanoparticles. The chemical identity, morphology and distribution of the nanoparticles are investigated through high-resolution XPS and AFM characterization. Enhanced UV absorption is demonstrated both experimentally and using optical simulations after addition of the CuO/SnO_2 nanoheterojunctions. The device performance improvements are attributed to the strong absorption in the CuO nanoparticles and electron transfer facilitated by the nanoheterojunctions. The PDs show a five-fold increase in peak responsivity at 0.2 V bias. The photoresponse factor, defined as the wavelength-dependent ratio between the photocurrent and dark current, was estimated to be 592 for the CuO-SnO_2 PD under 290 nm illumination.

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