World Academy of Science, Engineering and Technology
International Journal of Electronics and Communication Engineering
Vol:18, No:07, 2024

High Responsivity of Zirconium boride/Chromium Alloy Heterostructure for Deep and Near UV Photodetector

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Abstract : Photodetectors (PDs) play a pivotal role in optoelectronics and optical devices, serving as fundamental components that convert light signals into electrical signals. As the field progresses, the integration of advanced materials with unique optical properties has become a focal point, paving the way for the innovation of novel PDs. This study delves into the exploration of a cutting-edge photodetector designed for deep and near ultraviolet (UV) applications. The photodetector is constructed with a composite of Zirconium Boride (ZrB_2) and Chromium (Cr) alloy, deposited onto a 6H nitrogen-doped silicon carbide substrate. The determination of the optimal alloy thickness is achieved through Finite-Difference Time-Domain (FDTD) simulation, and the synthesis of the alloy is accomplished using radio frequency (RF) sputtering. Remarkably, the resulting photodetector exhibits an exceptional responsivity of 3.5 A/W under an applied voltage of -2 V, at wavelengths of 405 nm and 280 nm. This heterostructure not only exemplifies high performance but also provides a versatile platform for the development of near UV photodetectors capable of operating effectively in challenging conditions, such as environments characterized by high power and elevated temperatures. This study contributes to the expanding landscape of photodetector technology, offering a promising avenue for the advancement of optoelectronic devices in demanding applications.

Keywords : responsivity, silicon carbide, ultraviolet photodetector, zirconium boride
Conference Title : ICOP 2024 : International Conference on Optics and Photonics
Conference Location : Paris, France
Conference Dates : July 18-19, 2024

Open Science Index, Electronics and Communication Engineering Vol:18, No:07, 2024 publications.waset.org/abstracts/182866.pdf