Optimizing the Performance of $(Sb_{0.2}Sn_{0.8})_{0.5}(S_{0.9}Se_{0.1})_{0.5}$ Crystal-Based Self-Powered Photodetectors

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Through the direct vapor transport (DVT) method, we have synthesized a single crystal of the quaternary compound $(Sb_{0.2}Sn_{0.8})_{0.5}(S_{0.9}Se_{0.1})_{0.5}$. The crystal's chemical composition was determined via energy dispersive X-ray analysis (EDAX) while scanning electron microscopy (SEM) was used to observe its surface morphology. The powder X-ray diffraction (XRD) technique confirmed the crystal's orthorhombic structure. The lattice parameters closely resemble the reported data. A UV-VIS-NIR spectrometer was utilized to deduce a direct optical band gap. Raman spectroscopy was used to examine different phonon modes. By subjecting the grown crystal to different wavelengths and varying intensities of white light, we analyzed its pulsed photo response. Our analysis enabled us to determine favorable photodetection parameters as well as trap depth parameters.