Band Offsets, Optical Conduction, Photoelectric and Dielectric Dispersion in $InSe/Sb_2Te_3$ Heterojunctions

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InSe based heterojunction devices gain importance in optoelectronic applications in NIR range as multipurpose sensors. For this reason, $InSe/Sb_2Te_3$ heterojunctions are constructed as NIR sensors by the thermal evaporation technique. The structural, optical, dielectric and photoelectric properties of $InSe/Sb_2Te_3$ heterojunctions are explored by X-ray diffraction and ultraviolet-visible light spectrophotometry techniques. The structural analyses revealed the preferred growth of polycrystalline hexagonal Sb_2Te_3 onto amorphous InSe as a major phase. Optically, the coating of Sb_2Te_3 onto InSe enhanced the light absorbability of InSe by more than 18 times, redshifts the energy band gap, increased the dielectric constant by ~5 times and increased the optical conductivity by 35 times in the NIR range of light. A conduction and valance band offsets of 0.40 and 0.68 eV are determined for the $InSe/Sb_2Te_3$ heterojunction devices. In addition, the Drude-Lorentz fittings of the optical conductivity indicated a remarkable increase in the plasmon frequency values upon depositing of Sb_2Te_3 onto InSe. The illumination intensity and time dependent photocurrent measurements resulted in an enhancement in the photocurrent values by one order of magnitude. The response time

of the devices is sufficiently short to nominate the $InSe/Sb_2Te_3$ heterojunction devices as fast responding NIR sensors suitable for optoelectronic applications.

Keywords: $InSe/Sb_2Te_3$, dielectric, band offset, Drude-Lorentz model.