

Spin split-off transition based IR detectors operating at high temperatures

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Abstract

GaAs/AlGaAs based Heterojunction Interfacial Workfunction Internal Photoemission (HEIWIP) detectors were used to demonstrate experimental split-off response that is based on hole transitions between light/heavy hole bands and the split-off band (spin-orbit). Preliminary results indicate that, this detection mechanism is more efficient than free carrier mechanism for NIR operation. An unoptimized, GaAs/AlGaAs detector with a free carrier threshold wavelength of $\sim 20 \mu\text{m}$ showed a maximum operating temperature of 130 K for split-off response in the range $1.5\text{--}5 \mu\text{m}$ with a peak D^* of 1.0×10^8 Jones. By adjusting the free carrier threshold to match the split-off threshold, it should be feasible to further increase the operating temperature. Analysis indicates that practical devices with properly optimized parameters are capable of achieving room temperature operation with higher specific detectivity. The possible ways to tailor the threshold, for the split-off response to different wavelength rangers using different materials such as phosphides and nitrides are also discussed.

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