Growth and development of antimony-based III-V detector materials for the regime from eSWIR to LWIR

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The family of the 6.1 Å-materials (InAs, GaSb, AlSb), their ternary and quaternary alloys, and the corresponding type-II superlattices (T2SLs) permit wavelength tuning over a wide spectral range in the infrared (IR). The flexibility in detector design that these materials provide, allows for sophisticated device concepts and high-performance bandgap-engineered IR technology for various applications. Grown lattice matched on GaSb substrate by molecular beam epitaxy (MBE), these materials can be combined to address the requested requirements. At Fraunhofer IAF, we utilize these materials to develop IR detectors and arrays for the extended shortwave infrared (eSWIR), the mid-wavelength infrared (MWIR), the long-wavelength infrared (LWIR) and combinations thereof.
For the eSWIR region from 1.7 up to 3.0 µm, where InGaAs on InP substrates suffers from a high dislocation density resulting in limited performance, InGaAsSb on GaSb is currently under investigation for room temperature operation employing a heterojunction approach. This talk will report on fundamental material study as well as electro-optical characterization results of heterojunction diodes.
For the thermal infrared in the range from 3 up to 12 µm covering MWIR to LWIR, T2SLs based on InAs/GaSb and InAs/InAsSb are developed. The activities range from basic studies up to pilot line production with detectors at TRL9. Recent advances aiming at high operating temperatures (HOT) for MWIR, enhanced quantum efficiency for LWIR and extended sensitivity combining MWIR and LWIR diodes will be presented.

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