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Type II InAs/GaSb Superlattice Infrared Detectors with P-on-N Polarity Structures

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Type II InAs/GaSb superlattice(SLs) infrared detector emerges in recent years has shown its great potential for operating at room temperature and sensing in a wide range from 2 ㎛ up to 30 ㎛ at least. The performance of the strain layer superlattice infrared detectors (SLIP) based on these alloys are extremely good with a large quantum efficiency (~ 30-60 %) and long carrier lifetime (~㎲). In this paper, we report on high operating temperature mid wave infrared detectors (cut-off ~5 ㎛ at 300K) based on type-II InAs/GaSb superlattices with a P-on-N polarity. Presently, all InAs/GaSb strain layer superlattice photodiodes reported so far have an N-on-P polarity with a thin InAs n-type top contact, that is incompatible with most present day read out integrated circuits. The device structure consists of ~1.5 ㎛ 8ML InAs/8ML GaSb SL (300 periods) unintentionally doped absorber grown on top of 400 nm thick n-type contact layer (consisting of 8 ML InAs/8 ML GaSb SL with Si-doped InAs layers). This was followed by a 50 nm of p-type (Be-doped) thin GaSb layer, which served as the top contact. Current-voltage measurements reveal dark current density of ~5 x 10^{-7} A/cm^2 at 82 K and 0.18 A/cm^2 at 240 K (V_{bias} = -0.1 V). R_0A product was equal to ~ 1 x 10^5 cm^2 at 82 K and 0.24 cm^2 at 240 K. Zero-bias D^* was estimated to 2 x 10^{12} Jones and 2 x 10^9 Jones at 80 K and 240 K, respectively.