J Material Sci Eng 2015, 4:3
http://dx.doi.org/10.4172/2169-0022.S1.020

OMICS International
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International Conference on
Smart Materials & Structures
June 15 -17, 2015 Las Vegas, USA

Effect of interfacial layer on the performance of Type-II InAs/GaSb superlattices infrared photodetectors

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Infrared photo detector can be used for a variety of applications in the industrial, security, military, scientific, and medical areas. Various device materials been used for the growth of infrared device structures, such as quantum dots, quantum well and Type-II superlattices (T2SL).InAs/GaSb T2SLs are a considerable interest the last decade as a promising candidate in middle and long infrared photodetector and imaging application. InAs/GaSb T2SL was proposed by Sai-Halaseet al. in 1977. The T2SL is formed by alternatingInAs and GaSb layer over several periods. These structure have broken-gap energy alignment, where the separation of electrons and holes into the InAs and GaSb, respectively. The T2SL can be easily tuning optical and electronic properties by varying the layer thickness. One of major challenge is the control of overall strain, caused by the small lattice mismatch between InAs and GaSb.

In this study, we report on the optical and electrical device performance of T2SL based infrared photodetectors. The T2SL of p-i-n structure were grown using molecular beam epitaxy with As2 and Sb2 cracker source on a n-type GaSb substrate. We used an InSb interfacial layer for the strain compensation.The high-resolution x-ray diffraction (HR-XRD) and fourier transform infrared spectroscopy (FTIR) are used for structural and optical characterization. The cut-off wavelength of T2SL was red shifted (~0.14μm) at 77 K due to the InSb interfacial layer. In order to demonstrate the effect of InSb interfacial layer were compared using the dark current.

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