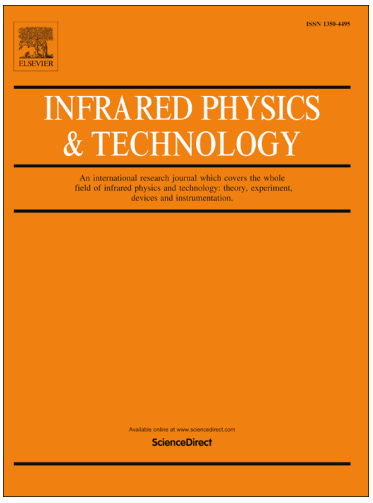

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MBE growth of high quality HgCdSe on GaSb substrates

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Abstract

This paper demonstrates MBE growth of high quality HgCdSe infrared materials on GaSb (211)B substrates. The as-grown $Hg_{1-x}Cd_xSe$ samples have a range of *x*-values (*x*= 0.37 to 0.18) and cut-off wavelengths (λ_c= 3.9 μm to 10.4 μm at 80K), and show typical n-type semiconductor behaviour. At a measurement temperature of 80K, the as-grown HgCdSe samples with *x*=0.18 present a cut-off wavelength of 10.4 μm, an electron mobility as high as 1.3×10^5 $cm^2V^{-1}s^{-1}$, a background electron concentration as low as 1.6×10^{16} cm^{-3}, and a minority carrier lifetime as long as 2.2 μs. These values of electron mobility and minority carrier lifetime represent a significant improvement on previous studies of MBE-grown HgCdSe reported in the open literature, and are comparable to those of corresponding HgCdTe materials grown on lattice-matched CdZnTe substrates. This high material quality is primarily due to the nearly lattice-matched epitaxial growth of HgCdSe on GaSb, as well as an optimised growth temperature. These preliminary results indicate that HgCdSe materials grown on GaSb can meet the basic material quality requirements for the fabrication of high performance infrared detectors, although further effort is required in order to reduce the background electron concentration to $<10^{15}cm^{-3}$. Furthermore, even higher quality HgCdSe materials on GaSb are expected by further optimization of the growth conditions, using higher purity Se source material, and implementing post-growth thermal annealing in a Se environment. The results of this study demonstrate the great potential of HgCdSe infrared materials grown on large-area commercially-available substrates for meeting the requirements of next generation infrared imaging focal plane arrays with features of lower cost and larger array format size.

Keywords: infrared materials; HgCdSe; GaSb; molecular beam epitaxy.

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