MASTER OF SCIENCE
IN
PHYSICS

DEMONSTRATION OF A NEAR AND MID-INFRARED QUANTUM WELL INFRARED DETECTOR

Michael P. Touse-Lieutenant, United States Navy
B.S., United States Naval Academy, 1997
Master of Science in Physics-September 2003
Advisor: Gamani Karunasiri, Department of Physics
Second Reader: James Luscombe, Department of Physics

In this thesis a device was designed to ultimately detect a laser designator operating at 1.06 μm and infrared radiation near 10 μm simultaneously. The final design consisted of 25 quantum step wells 80 μm wide. The peak IR absorption coefficient was 1800 cm^{-1} at 11.1 μm with a bandwidth of 1.6 μm. Dark current was measured to be 1.6×10^{-8} A at 1 V bias at 10 K and a background photocurrent of 4.6×10^{-6} A at 10 K. The background-limited performance of the device occurs at approximately 55 K. The barrier height of the well was 99 meV. The maximum responsivity for each band was measured to be 0.04 A/W at 840 nm and 0.69 A/W at 10.93 μm. Detectivity was then calculated to be 3.4×10^{10} $cm\sqrt{Hz}/W$ in the NIR band and 6.5×10^{11} $cm\sqrt{Hz}/W$ in the IR band. D* at the background limited point (D^*_{BLIP}) was 2.0×10^{9} $cm\sqrt{Hz}/W$ in the NIR and 3.9×10^{10} $cm\sqrt{Hz}/W$ in the IR.

KEYWORDS: Quantum Well Infrared Photodetector, QWIP, FTIR