Very Long Wavelength Quantum Well Infrared Photodetectors

S. D. GUNAPALA, Center for Space Microelectronics Technology, Jet propulsion Laboratory, California Institute of Technology, Pasadena. CA 91109

Very long wavelength infrared (VWIR) photodetectors, 14 μm to 20 μm, are of a great interest for a variety of space-borne applications, relative humidity profiles. cloud characteristics, and the distribution of minor constituents in the atmosphere which are being planned for the NASA's Earth Observing System (EOS). These space-borne applications have placed stringent requirements on the performance of the infrared detectors and arrays including high defectivity, low dark current, uniformity, radiation hardness and lower power dissipation. To meet these stringent requirements, the VWIR QWIPs can be optimized in two different ways: efficient light coupling and dark current reduction (and hence lower noise current). In our previous presentations we discussed the efficient light coupling achieved by using a random scattering reflector. In this presentation we will discuss the optimization of quantum well structure having the lowest dark current and the highest performance in the spectral region of 14 to 16 μm. Systematic measurements were made on several consecutively grown samples on a well calibrated MBE machine. These samples which cover most of the important VWIR spectral region differed only in their quantum well parameters (i.e., well width and barrier height). Dynamic resistance, temperature dependent dark current as well as noise, and spectral responsivity are combined to analyze the relationship between the quantum well parameters and the performance.