

DEVELOPMENT OF LOW-NOISE ULTRAVIOLET DETECTORS BASED ON GROUP-III NITRIDES

Ultraviolet (UV) sensors for space astronomy have requirements distinct from those for industrial or military applications. First, they must be insensitive to light at optical wavelengths, because astronomical objects often emit 10^4 – 10^8 visible photons for every UV photon. Further, these detectors are required to generate minimal noise and dark current, since noise arising from the background often dominates in faint UV observations. Detector arrays must be addressed using low-noise readout techniques and they must be resistant to the effects of operation in space.

With their wide bandgaps, high thermal conductivities, chemical inertness, and radiation hardness, UV detectors implemented in GaN, AlN, and their alloys offer significant potential for solar-blind UV detectors capable of operating at high temperatures and in hostile environments. Device quantum efficiencies of AlGaIn-based detectors are potentially several times greater than those of competing UV detector technologies.

In the last several years, nitride-based solar-blind UV detectors have made the transition from theoretical interest to practical application. While the vast majority of these detectors were fabricated from epilayers grown on sapphire substrates by metalorganic chemical vapor deposition (MOCVD), only a few utilized silicon as the substrate and only a few grew epilayers by molecular beam epitaxy (MBE). Nevertheless, the use of silicon offers many benefits: large-area, low-cost, highly perfect substrates are readily available, a very sophisticated backside process technology has been developed over many years, and thermal expansion mismatch between detector arrays and readout electronics would be mitigated. I will describe GaN Schottky barrier diodes grown on Si(111) substrates by gas-source molecular beam epitaxy (GSMBE). These diodes exhibited extremely low reverse bias leakage currents and record low noise for GaN Schottky diodes on silicon. In addition, results for *p-n* diodes fabricated from epilayers grown on sapphire by GSMBE will be presented.

BIO

Dr. Peter W. Deelman is a Member of Technical Staff in the Device Research and Applications Section of the Jet Propulsion Laboratory. At JPL he has worked on the development of solar blind UV imager arrays based on III-nitrides, the advanced development of delta-doped CCDs for UV and charged particle detection, and the development of an arcjet nitrogen source for the selected energy epitaxy of nitride-based materials. Dr. Deelman obtained his Ph.D. in Physics from Rensselaer Polytechnic Institute, where his research focused on strain relaxation of Ge/Si heterostructures grown by molecular beam epitaxy.