particle trigger with, or in place of, the detector stack.

The spherical Cherenkov detector would include a sphere of ultraviolet-transparent material (e.g., sapphire, quartz, or an acrylic polymer) having an ultraviolet index of refraction greater than 1. The sphere would be coated with an ultraviolet-reflecting material except at small ports. SiC photodiodes or optical fibers leading to photodiodes would be mounted facing into the sphere at the ports to enable detection of Cherenkov ultraviolet light emitted within the sphere.

The detectors in the stacks would serve as triggers for collection of light by the photodiodes of the spherical Cherenkov counter. The direction and length of the path of a triggering particle would be determined from the identities (and thus the positions) of the affected detectors and stacks. For incident ions having sufficiently high kinetic energies, the strengths of the signals from the SiC photodiodes or optical fibers would be proportional to the square of the electric charges of the ions multiplied by the path lengths. Hence, a velocity distribution for high-energy ions incident from multiple directions could be determined.

For less-energetic incident particles, further sorting could be accomplished through correlation of the Cherenkov signal from the sphere with differences among signals from stacked detectors that have different thicknesses and that may be interspersed with energy-moderating materials. Sensitivity of detection could be increased through substitution of low-noise SiC detectors for ordinary SiC detectors.

This work was done by John D. Wrbanek, Gustave C. Fralick, and Susan Y. Wrbanek of Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18362-1.

AlGaN Ultraviolet Detectors for Dual-Band UV Detection

This technology can be used in multicolor imaging for flame temperature sensing and counter-camouflage/biosensing applications.

Goddard Space Flight Center, Greenbelt, Maryland

This innovation comprises technology that has the ability to measure at least two ultraviolet (UV) bands using one detector without relying on any external optical filters. This allows users to build a miniature UVA and UVB monitor, as well as to develop compact, multicolor imaging technologies for flame temperature sensing, air-quality control, and terrestrial/counter-camouflage/biosensing applications.

The structure is designed for back illumination and contains six AlGaN layers with different doping, Al percentage, and two contacts — A and B. The cut-off wavelength of AlGaN can be tuned from 200 nm to 365 nm by changing the Al percentage. There are three band-edges in this structure that correspond to $Al_xGa_{1-x}N$, $Al_yGa_{1-y}N$, and $Al_zGa_{1-z}N$ — x, y, and z should be designed to be $x>y>z$ for back illumination.

When photons are injected from the backside, they will be absorbed at different layers depending on the wavelength of the photons. Electrically, the device is a back-to-back pin structure along the vertical direction. When B is biased positively, and A is connected to the ground, the bottom pin is forwardly biased and acts as a current variable resistor with resistance becoming negligible when the bias on B is high enough. While the bottom pin is forward biased, the top pin junction is reverse biased and acts as a detector. Because the depletion mainly happens in the n-$Al_zGa_{1-z}N$ layer, only the photons absorbed in n-$Al_zGa_{1-z}N$ will be converted into photon-current. When the bias is applied in an opposite manner, in which B is biased negatively and A is connected to the ground, the bottom pin is biased in reverse and acts as an active detector. The depletion region is mainly in n- $Al_yGa_{1-y}N$ and the photons with wx<wp<wy can be converted into photocurrent. When wp<wx, all photons will be absorbed in the bottom n+$Al_xGa_{1-x}N$ layer. Most of the photoelectrons will be recombined locally without generating photocurrent.

By charging the polarity of the bias, the detector can selectively detect two different wavebands: wy<wp<wz, when positive bias is applied on A, and wx<wp<wy when negative bias is applied on A. The detector is blind to wp<wx (no photocurrent) and wp>wz (no absorption). Practically, wx, wy, and wz are tunable between 250 nm to 300 nm. The percentage of Al in the p+ layer in the center can be any number between y and z. As a result, the two detection bands do not have to be continuous.

This work was done by Laddawan Miko, David Franz, and Carl M. Stahle of Goddard Space Flight Center and Feng Yan and Bing Guan of MEI Technologies, Inc. Further information is contained in a TSP (see page 1). GSC-15163-1