



## Instrumentation

# Fast, Large Area, Wide Band Gap UV Photodetector

Compact, energy-efficient UV photodetector provides broad spectral sensitivity with an excellent response rate

Innovators at NASA's Glenn Research Center have developed a solid-state device with the ability to detect small, fast pulses of the full range of ultraviolet light (UVA, UVB, and UVC) in two nanoseconds or less. This photodetector is high-frequency, high-voltage, and high-temperature compatible, and uses biologically safe, commercially available semiconductor zinc oxide (ZnO) in a bridge circuit.

Originally designed as a spacecraft-based radiation detector, the device covers a large detection area and is highly sensitive. With its excellent response time and lower wavelength sensitivity capabilities, the UV detector has a number of practical Earth-based applications.

## BENEFITS

- ⇒ High-speed: Boasts an excellent response time (two nanoseconds or less) with a large detection area
- ⇒ Compact: Features a simple, lightweight design
- ⇒ Energy-efficient: Requires less power by eliminating the need for photomultiplier tubes
- ⇒ Robust: Thermally stable and resistant to damage or malfunctions caused by radiation in outer space or at extremely high altitudes
- ⇒ Readily available: Uses a commercially available, affordable, and biologically safe substrate



technology solution

## THE TECHNOLOGY

Glenn's photodetector was designed to address the shortcomings of vacuum-tube-based radiation detector systems for Cherenkov Light Detection used to facilitate manned and unmanned deep space missions and high-altitude aircraft safety. Detector systems that rely on photomultiplier tubes are not only large, they run at high voltages, have high noise levels, and require special packaging and great care when being transported. This innovation addresses the need for a smaller, lighter device that allows more space for power and payloads.

This solid-state device, which is fabricated on bulk, single-crystal undoped ZnO, eliminates the need for photomultiplier tubes. It is a resistive sensor and can be fabricated using standard microfabrication processes. Interdigitated finger electrodes and contact pads are patterned using photolithography, and formed by a high-conductivity metal such as silver or platinum. It is typically operated in a half-bridge configuration and an applied electric field directs the drift of conductive electrons when the device is exposed to UV light. While the response time is dependent on electrode spacing, the wavelength is not, allowing it to be easily reconfigured to various tolerances as needed. As a result, this device is able to detect very specific kinds of UV light, making it an ideal choice for a variety of industries that rely on accurate, high-speed photodetection.



UV phototherapy is used to treat a number of medical conditions including neonatal jaundice



Photodetectors are useful in monitoring hydrocarbon flames because they emit a UV component

## APPLICATIONS

The technology has several potential applications:

- ⇒ Biotechnology (microbial decontamination processing, spectrophotometry analysis)
- ⇒ Biomedical
- ⇒ Environmental monitoring (fire, ozone)

## PUBLICATIONS

Patent No: 10,054,691

National Aeronautics and Space Administration

**Agency Licensing Concierge**

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