

## Research highlights

### Gallium nitride ultraviolet detector with integrated silicon amplifier

Gallium nitride (GaN) and related materials are extensively used for the fabrication of blue LEDs and lasers. In addition to such light emitting devices, the ability to vary the band gap of gallium nitride compounds over a wide energy range offers potential for the fabrication of ultraviolet (UV) detectors for applications such as flame and heat sensors and medical imaging. Gallium nitride UV detectors may replace conventional photomultiplier and silicon detectors.

However, current GaN based UV detectors necessitate connection of external transistor circuits to amplify the otherwise weak signal from the UV detector.

Here Chang Yong Lee and colleagues at Toyohashi University of Technology describe the realization of GaN Schottky diode UV detectors with integrated silicon-charge transfer type signal processors, thereby eliminating the requirement to-date for attaching external transistor circuits to amplify the weak signal from the GaN UV detector.

The UV sensor consisting of a Au-GaN photodiode and n-MOS signal processor was produced by a MOS/PD seamless process. The key stages of the fabrication process are wafer bonding the GaN-based PD to the MOS signal processor by metal contacting; isolation of the PD by reactive ion etching; gate electrode patterning; deposition of passivation layer; and electrode formation.

Operation of UV detector device consists of GaN Schottky barrier diode having 10-nm-thick Au semitransparent Schottky contact and silicon-charge transfer type signal processor fabricated in Toyohashi Tech was successfully reported. The main feature of this UV detector is the extremely wide sensitivity range that can be achieved by changing the number of integration cycles at the silicon-charge transfer circuit. The authors estimate that the device can detect UV signal as low as  $10\text{pW/m}^2$  from flames, and the GaN and Si heterogeneous detector could also be utilized for new type of flame sensor by high-resolution image capturing in UV and visible region at a same time with wide dynamic range.

#### Reference

Intelligent Ultraviolet Sensor Composed of GaN-Based Photodiode and N-Channel Metal Oxide Semiconductor Si-Charge Transfer Type Signal Processor  
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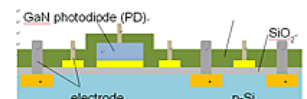
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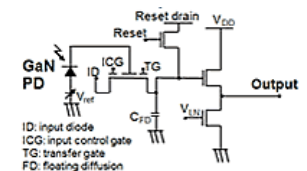
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Concept of intelligent ultraviolet (UV) sensor composed of GaN-based photodiode and Si n-MOS signal processor



Circuit diagram of intelligent UV sensor