Blind spot reveals biological agents

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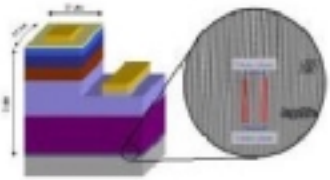
US researchers have demonstrated a solar-blind avalanche photodiode (APD) that could be used in a universal detector for biological agents. They say that once they have optimized the technology their sensitive device could be combined with ultraviolet light-emitting diodes (LEDs) to create an inexpensive detection system capable of identifying the unique spectral fingerprints of most biological weapons. The same technology might also be used for military communications in the field.

General APD scheme



[Click here to enlarge]

Manijeh Razeghi of Northwestern University's Center for Quantum Devices and her colleagues have demonstrated a 280 nm APD based on the semiconductor aluminium gallium nitride (AlGaN) with a photocurrent gain of more than 700. The researchers' approach allowed them to overcome the major obstacle in developing high-performance solar-blind APDs: the high number of crystalline defects present in AlGaN semiconductor materials. They could produce relatively high-quality AlGaN with fewer defects, which produced avalanche gain in the solar-blind region.

The researchers expect such a tiny APD to be capable, in principle, of single photon detection, which would make it far more sensitive than any photomultiplier tube (PMT) currently used for the short wavelength ultraviolet region. Moreover, solid state APDs would be far less fragile than PMT devices, be more compact, and less costly to produce.

"Current systems are based upon bulky lasers and fragile vacuum tube detectors," explains Razeghi, "The use of efficient semiconductor-based UV light sources and high sensitivity semiconductor avalanche photodiodes would enable the overall detection/identification system to be more compact, inexpensive, and portable with lower power consumption than current existing biological and chemical agent detection systems."

At wavelengths of 280 nm, the so-called solar-blind region, the ozone layer filters out ultraviolet so that background levels are very low. Solar-blind APDs can take advantage of this phenomenon. As such, Razeghi suggests that advanced APD technology could outsmart PMTs in secure battlefield communications by using a combination of compact, inexpensive ultraviolet LEDs and APDs.

Razeghi presented the team's latest work at an invitation only Defense Advanced Research Projects Agency (DARPA) meeting: "Workshop on Deep Ultraviolet Photodetectors", held 26th August, Arlington, Virginia.

Related Links and references:

- Manijeh Razeghi's homepage
- Semiconductor Ultraviolet Optical Sources (DARPA)
- Center for Quantum Devices

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