

First Ultraviolet Light Silicon-Based Photodetector Invented by UIUC

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By depositing thin films of silicon [nanoparticles](#) on silicon substrates, researchers at the University of Illinois at Urbana-Champaign have fabricated **a photodetector sensitive to ultraviolet light**. Silicon-based ultraviolet sensors could prove very handy in military, security and commercial applications.

"Silicon is the most common semiconductor, but it has not been useful for detecting ultraviolet light until now," said Munir Nayfeh, a professor of physics at Illinois and a researcher at the Beckman Institute for Advanced Science and Technology. "Ultraviolet light is usually absorbed by silicon and converted into heat, but we found a way to make silicon devices that absorb ultraviolet light and produce electrical current instead."

As will be reported in the August issue of the journal Photonics Technology Letters, the technique behind silicon sensing of ultraviolet light is compatible with conventional integrated circuit technology. Conveniently, both the sensor and the computer could be incorporated on the same chip.

To create their ultraviolet-based photodetectors, Nayfeh, graduate students Satish Rao, Adam Smith and Joel Therrien, and undergraduate student Osama Nayfeh begin with nanoparticles dispensed from silicon wafers using electrochemical etching. The nanoparticles are about 1 billionth of a meter in diameter and contain about 30 silicon atoms.

The researchers then deposit a thin film of the nanoparticles in a hole etched into the surface of another silicon wafer using standard lithographic techniques. Small conductive pads of gold complete the assembly. Electricity flows when ultraviolet light strikes the nanoparticles.

"Ultraviolet light efficiently couples to the nanoparticles and produces electron-hole pairs," said Nayfeh, who also is a researcher at the university's Center for Nanoscale Science and Technology. "Contrary to what occurs in bulk silicon, the electron-hole pairs do not appreciably recombine by non-radiative processes. Strong quantum confinement allows for charge separation and collection."

Combining silicon nanoparticles with conventional silicon wafers could offer the best of both material systems, Nayfeh said. "Placing a thin layer of nanoparticles on the front of a silicon solar cell, for example, could improve the cell's efficiency and its lifetime."

Other applications include ultraviolet-based detectors for missile-warning systems and airborne biological agents, industrial flame sensors and suntan monitors.

The National Science Foundation; the state of Illinois; the Grainger Foundation; and the Technology Research, Education, and Commercialization Center funded the work. TRECC is managed by the National Center for Supercomputing Applications and funded by a grant from the Office of Naval Research. The researchers have applied for a patent.

Source: [University of Illinois at Urbana-Champaign](#)

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