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Photonic-organic Electrochemical Transistor

A light-driven transistor offering low-energy, crosstalk-resistant signaling for neuromorphic sensors and artificial-retina systems.

Researchers at Purdue University have developed a photonic-organic electrochemical transistor (POECT). This device uses the 3-terminal layout of a conventional transistor (source, drain, gate), but uses light rather than electricity as the means of signal transmission enabling significantly faster transmission while mitigating crosstalk. Test results from a prototype POECT demonstrated continuously programmable conductance states and low writing energy. Applications of this technology will allow for the creation of systems that emulate biological synapse functions or artificial retinas.

Advantages:

- Ultra-fast signal transmission

- Limited crosstalk between transistors

- Continuously programmable conductance states

- Low writing energy

Applications:

- Biosensors

- Synaptic devices for biological applications

- Neuromorphic computing

- Emulation of biological elements (artificial retina)

Technology Validation:

This technology has been validated with lab-scale fabrication and testing of the proposed device.

Related Publications:

Technology ID

2023-MEI-70196

Category

Computing/Photonic & Optical Computing Technologies
Medtech & Digital Health/Implantable Medical Devices
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

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Ke Chen et al, Organic optoelectronic synapse based on photon-modulated electrochemical doping, Nature Photonics (2023). DOI: 10.1038/s41566-023-01232-x

https://techxplore.com/news/2023-11-human-eye-boost-vision-efficiency.html

TRL: 5

Intellectual Property:

Provisional-Patent, 2023-03-09, United States | PCT-Patent, 2024-03-07, WO | NATL-Patent, 2025-06-26, United States