PURDUE INNOVATES | Office of Technology Commercialization

# Photoswitchable Nanoelectronics based on 2D Materials and Photochromic Molecules

**Light-programmable tuning of MoSe2 devices using photochromic molecules to enable switchable phototransistors and adaptive optoelectronics.**

Researchers at Purdue University have developed a facile strategy for modulating electronic band energies of the monolayer MoSe2 with external light. Fine-tuning optical and electrical properties of two-dimensional (2D) semiconductors has sparked considerable interest in transition metal dichalcogenides (TMDs). Multiple approaches such as polarization switching and spin-valley tuning have been contrived to modulate charge transport in TMDs, but these tactics present challenges in manufacturing and characterization processes.

This method developed by Purdue University researchers generates a new class of photoswitchable nanoelectronics that preserve the unique characteristics of MoSe2. The fabrication strategy can be leveraged to create versatile and multi-responsive optoelectronics, ultimately serving as an invaluable tool to program electronic devices. This new photo-control method helps expand the library of 2D material-based electronics and opens novel opportunities for designing new phototransistors and other 2D optoelectronic devices.

Related Publications: Park, S., Ji, J., Cunningham, C. et al. Photoswitchable optoelectronic properties of 2D MoSe2/diarylethene hybrid structures. Sci Rep 14, 7325 (2024). https://doi.org/10.1038/s41598-024-57479-z

**Technology Validation:**

Ten cycles of photoluminescence (PL) modulation demonstrated photoswitchable optoelectronic properties of the monolayer MoSe2 with photochromic diarylethene (DAE). Findings proved the viability of charge transport modulation on 2D semiconductors by simple external light illumination.

**Advantages**:

**Technology ID**
2024-CHOI-70540

**Category**
Materials Science & Nanotechnology/Nanomaterials & Nanostructures
Computing/Photonic & Optical Computing Technologies
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

**Further information**
Will Buchanan
wdbuchanan@prf.org

**View online page**

-Offers simplicity in preparation and device operation of optoelectronic devices

-Preserves the unique characteristics of MoSe2

-Provides opportunities for designing new phototransistors and other 2D optoelectronic devices

-Could provide thinner channels in integrated circuits

**Applications**:

-Phototransistors

-Photodetectors

-Memristors

-LEDs

-Displays

**TRL:** 4

**Intellectual Property:**

Provisional-Gov. Funding, 2024-03-08, United States

Utility-Gov. Funding, 2025-03-06, United States

**Keywords:** catalysts, Chemical Engineering, Materials and Manufacturing, Toluene methylation, Xylene, Zeolites