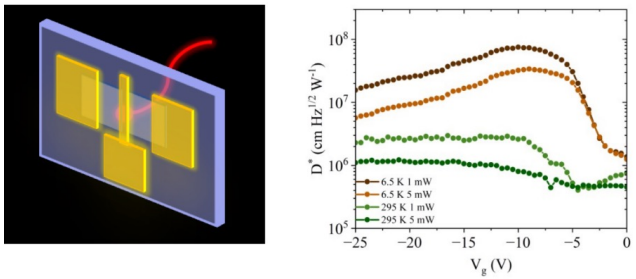
# Polycrystalline GeSn Phototransistors for the Short-Wave Infrared

## Scientific Achievement

Polycrystalline GeSn thin films on an amorphous silica substrate were characterized and phototransistors made from the GeSn thin films were demonstrated. The phototransistors showed a gate-tunable infrared photoresponse with responsivities up to 1.7 mA/W with only a 30 nm-thick GeSn layer.




Schematic of phototransistor; specific detectivity at 1600 nm as a function of gate bias.

## Significance and Impact

GeSn is a group-IV semiconductor that can be made direct bandgap.
It is compatible with the existing Si CMOS technology.
The demonstrated photoresponse from a very thin GeSn film grown on an amorphous substrate paves the way for back-end-of-the-line integrated photodetectors, with night-vision and telecommunications applications.

## Research Details

- Polycrystalline GeSn (~10% Sn) was characterized with Raman and photoluminescence spectroscopy, X-ray diffraction, electron backscatter diffraction, and energy-dispersive X-ray spectroscopy
- Phototransistors were fabricated and characterized as a function of wavelength, gate voltage, and temperature.


Petluru, P.; Liu, S.; McClintock, L.; Norden, T.; Wang, Y.; Muhowski, A. J.; Deitz, J.; Ruggles, T.; Lu, P.; Padmanabhan, P.; Liu, J.; Lu, T.-M. Gate-Tunable Short-Wave Infrared Polycrystalline GESN Phototransistors on Noncrystalline Substrates. ACS Applied Materials & Interfaces 2025, 17 (10), 15593–15602.



Work was performed, in part, at the Center for Integrated Nanotechnologies.