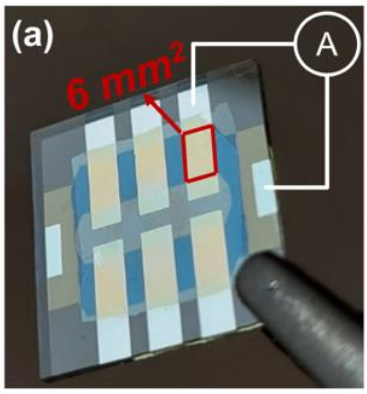
Scalable photodetector

Photodetector without external power source

Invention

Photodetectors and optoelectronic sensors usually need a power supply for the internal photoelectric effect to convert light into an electrical signal.

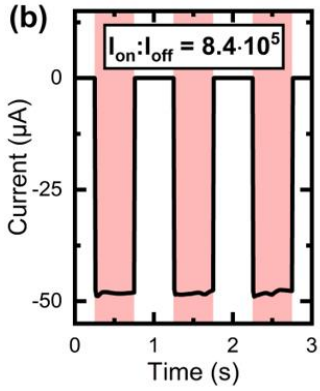
That is not the case with the University of Duisburg-Essen's self-sufficient photodetector, which dispenses with any external power supply. It does this with a heterojunction of two different transition metal dichalcogenides. The different chemical potentials of the two materials separate the charge carriers that the light generates. The heterojunction is also embedded in specifically adapted hole or electron transport layers located above and below it to conduct energy from the charge carrier to the outer metallic contacts with as little loss as possible. To manufacture transition metal dichalcogenides of nm thickness, a MOCVD method is used that is familiar from the semiconductor industry and known to be scalable. The process can also be applied to plastics.



a) Patent prototype processed on a large scale for self-sufficient photodetection with an active surface of 6 mm2

Commercial Opportunities

This invention is advantageous in such areas as the manufacture of optoelectronic sensors whose conceptual design prohibits external power sources, as is the case for biocompatible optical sensors in medical technology. Self-sufficient photodetector concepts allow reduction of component size, manufacturing complexity, and the associated costs. Voltage-free operation allows in situ and remote applications, especially for IoT.



b) A time-dependent current measurement at V = 0 V and pulsed light irradiation with a wavelength of λexc = 620 nm and a photon flux density of Φph = 1017 cm-2s-1 achieve a light switching ratio Ion:Ioff of 8.4·105.

Current Status

A prototype has been manufactured and measured, and initial function tests performed on it have confirmed that the invention is advantageous. Registration with the German Patent and Trademark Office and other subsequent international applications are possible in the priority year. We are offering interested companies the opportunity to license and refine the technology in collaboration with the inventors and the University of Duisburg-Essen.

An invention of University of Duisburg-Essen.

Competitive Advantages

- No external power source required
- Energy-self-sufficient
- Scalable detectors
- Uses the MOCVD method
- Flexible substrate-capable manufacturing process

Technology Readiness Level

1 2 3 4 5 6 7 8 9

Technology validated in lab

Industries

- Electrical engineering
- Semiconductor technology
- Optical sensors
- Photodetectors

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