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PRESS RELEASE

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Subject line: High photosensitivity 2D-few-layered molybdenum diselenide phototransistors

Researchers at Toyohashi University of Technology, Japan have fabricated High photosensitivity back-gated field-effect phototransistors made of only 20 nanometer thick molybdenum diselenide (MoSe₂) crystals by facile mechanical cleavage and transfer of MoSe₂ flakes onto a silicon wafers for next generation for photodetector applications.

This article is featured in the December 2014 issue of the Toyohashi Tech e-Newsletter:

http://www.tut.ac.jp/english/newsletter/research_highlights/research05.html

Two-dimensional (2D) layered materials are now attracting a lot of interest due to their unique optoelectronic properties at atomic thicknesses. Among them, graphene has been mostly investigated, but the zero-gap nature of graphene limits its practical applications. Therefore, 2D layered materials with intrinsic band gaps such as MoS₂, MoSe₂, and MoTe₂ are of interest as promising candidates for ultrathin and high-performance optoelectronic devices.

Here, Pil Ju Ko and colleagues at Toyohashi University of Technology, Japan have fabricated back-gated field-effect phototransistors made of MoSe₂ crystals having a thickness of only twenty nanometers. The devices were fabricated by mechanical cleavage of MoSe₂ crystals into few-layered flakes, followed by transfer onto a silicon wafer with pre-deposited titanium electrodes.

Despite their ultra-thin physical size, the devices showed excellent field-effect phototransistor characteristics. The measured photoresponsivity of 97.1 AW⁻¹ at zero back gate voltage was higher than previous reports of photodetectors fabricated using GaS, GaSe, MoS₂, and InSe. The photoresponse of the MoSe₂ was much faster (less than 15 msec) than ultrasensitive photodetectors based on monolayer MoS₂. Furthermore, the theoretical external quantum efficiency was 280-fold higher than of commercial Si and InGaAs photodiodes.

The research shows that MoSe₂ is a promising material for photodetector applications. The group is optimization the device performance by studying thickness-dependent of the photosensitivity.

Reference:

Authors: Abdelkader Abderrahmane, Pil Ju Ko, Tran Viet Thu, Shunji Ishizawa, Tsukasa Takamura and Adarsh Sandhu.

Title of original paper: High photosensitivity few-layered MoSe₂ back-gated field-effect phototransistors.

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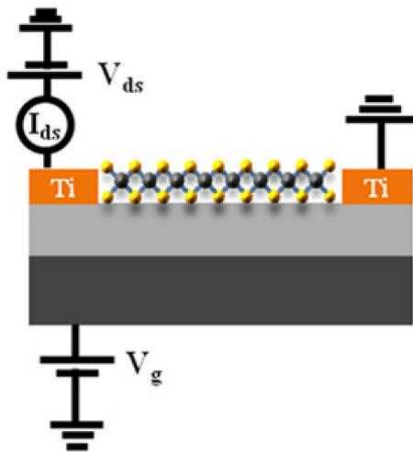
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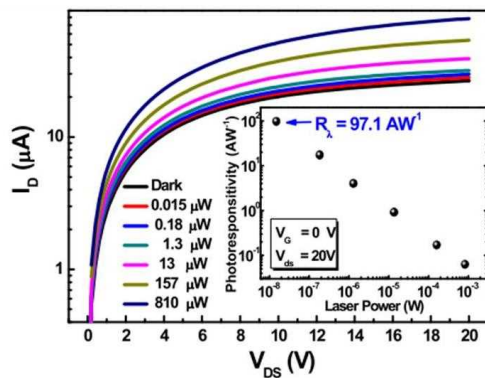
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Caption: Schematic structure of the few-layered MoSe2 FETs.



Caption: Laser power dependence of the drain current versus the drain-source voltage at zero gate voltage. Inset: photoresponsivity extracted from the Id-Vds characteristic.



Pil Ju Ko



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About Toyohashi University of Technology:

Founded in 1976 as a National University of Japan, Toyohashi University of Technology is a vibrant modern institute with research activities reflecting the modern era of advanced electronics, engineering, and life sciences.

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