# Substitutional doping of 2D semiconductor for broadband photodetector

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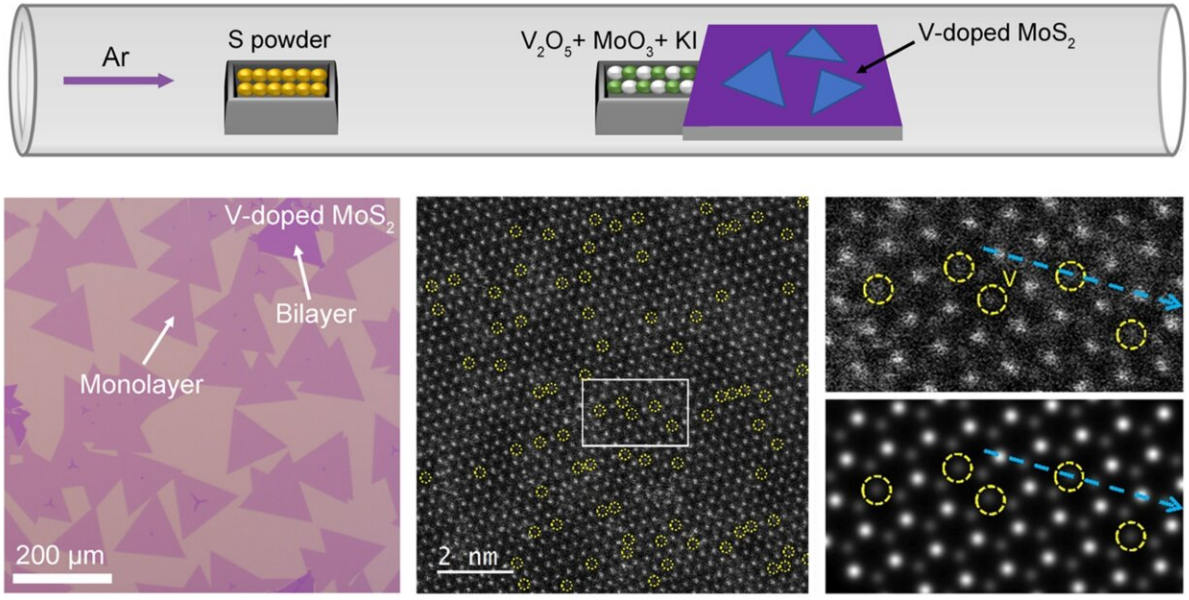


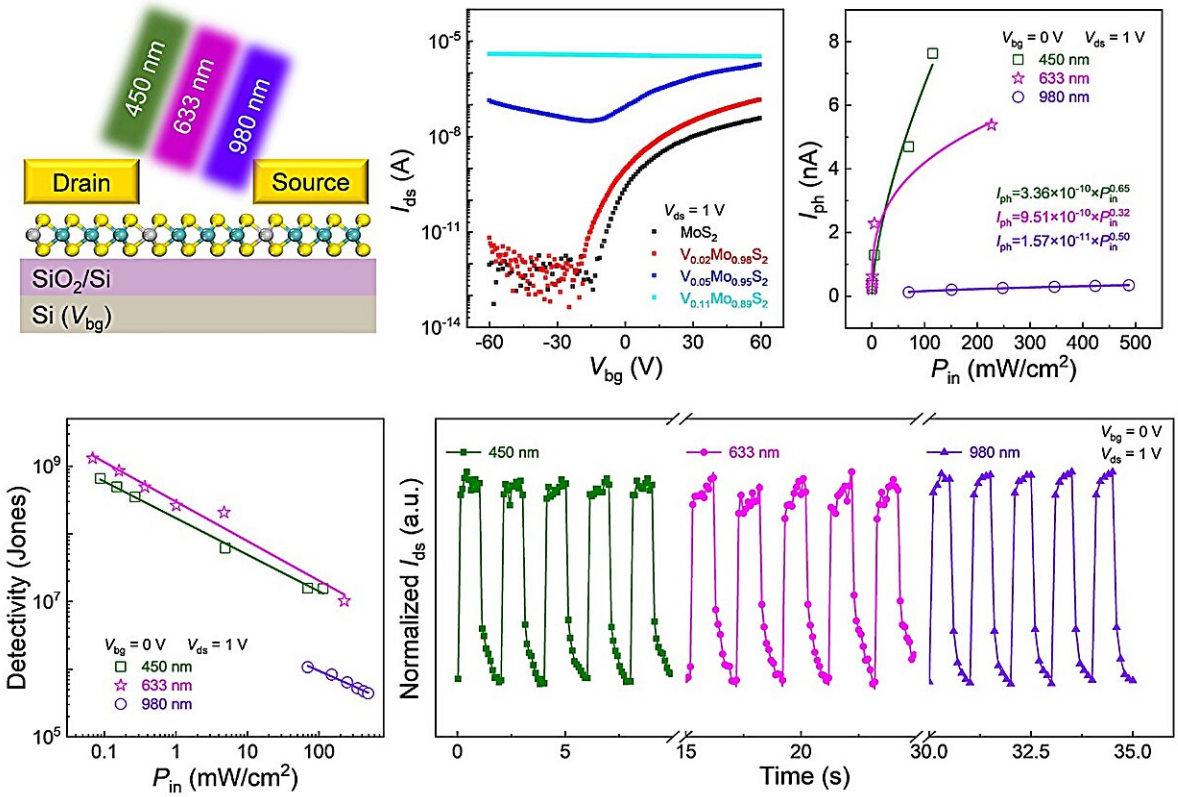

A V-doped $MoS_2$ monolayer is achieved through chemical vapor deposition method. Credit: *Frontiers of Optoelectronics* (2023). DOI: 10.1007/s12200-023-00097-w

Substitutional doping from foreign elements stands out as a preferred method for precisely tailoring the electronic band structure, conduction type, and carrier concentration of pristine materials. In the realm of three-dimensional (3D) monocrystalline silicon, for instance, the introduction of boron (B) and nitrogen (N) atoms as acceptor and donor dopants, respectively, has proven highly effective in enhancing carrier

mobility. This improvement positions silicon for advanced applications in integrated circuits.

Expanding into the realm of two-dimensional (2D) semiconductors, molybdenum disulfide ($MoS_2$) holds immense potential for future optoelectronic devices. However, the controllable doping strategies for 2D materials and their prospective application directions necessitate further exploration. As a new frontier in materials science, the quest for optimal doping methodologies in 2D materials continues to unfold, paving the way for unprecedented advancements in the field of optoelectronics.

Researchers led by Anlian Pan, Dong Li and Shengman Li from Hunan University, China, are dedicated to pioneering the synthesis of large-area, high-quality, and low-defect-density 2D semiconductors. Their research focuses on unraveling the photoelectric properties of these materials and exploring their potential in future device applications.




Tunable transport properties as well as broad spectral photo response is demonstrated in V-doped $MoS_2$-based device. Credit: *Frontiers of Optoelectronics* (2023). DOI: 10.1007/s12200-023-00097-w

Building on the foundation of preparing high-mobility pure $MoS_2$, the researchers delved into the realm of foreign substitutional doping, introducing vanadium (V) atoms. Their approach aimed to fine-tune the transfer characteristics of $MoS_2$ by varying the V doping concentration. Notably, their investigations revealed that V-doped $MoS_2$ monolayers with low doping concentrations exhibited enhanced B-exciton emission, showcasing promise for applications in broadband photodetectors.

The work, titled "Vapor growth of V-doped $MoS_2$ monolayers with enhanced B-exciton emission and broad spectral response," was

published in *Frontiers of Optoelectronics* on Dec. 7, 2023. This research contributes valuable insights to the evolving landscape of two-dimensional semiconductors and their potential impact on optoelectronic technologies.

**More information:** Biyuan Zheng et al, Vapor growth of V-doped $MoS_2$ monolayers with enhanced B-exciton emission and broad spectral response, *Frontiers of Optoelectronics* (2023). DOI: 10.1007/s12200-023-00097-w

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