

## 突破 MXenes 的光学性能 ——二维异质结构提供新的思路

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MXenes 是一类新发现的二维层状材料, 它展示出可调和光学、化学和电子的迷人特性, 并在光电、光热和光伏领域有着多样化的应用。MXenes 还具有很强的非线性光学响应, 并且其非线性光学吸收可以通过厚度、激发波长和表面基团来调节。

中南大学何军教授研究团队提出了一种简便有效地制备 Nb<sub>2</sub>C/MoS<sub>2</sub> 异质结构并改善其线性和非线性光学性能的方法。该工作成功地在 Nb<sub>2</sub>C 纳米片表面原位生长了 MoS<sub>2</sub> 纳米晶, 构建了一种二维 Nb<sub>2</sub>C/MoS<sub>2</sub>

异质结构, 并发现它在线性和非线性光学方面都优于纯 Nb<sub>2</sub>C; 揭示了 Nb<sub>2</sub>C 的表面基团可以调节 Nb<sub>2</sub>C/MoS<sub>2</sub> 的功函数, 从而影响 Nb<sub>2</sub>C 和 MoS<sub>2</sub> 之间的电荷转移和能量排列; 证明了 Nb<sub>2</sub>C/MoS<sub>2</sub> 继承了 Nb<sub>2</sub>C 和 MoS<sub>2</sub> 在不同波长下的优势, 并表现出增强的宽带光吸收特性。该工作表明了 Nb<sub>2</sub>C/MoS<sub>2</sub> 异质结界面空穴转移诱导其非线性光响应调制, 并展示了 Nb<sub>2</sub>C/MoS<sub>2</sub> 相比于纯 Nb<sub>2</sub>C 具有更强大且可调节的近红外非线性光吸收特征, 且其非线性吸收系数高出纯 Nb<sub>2</sub>C 两倍以上。

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## Breakthrough in the optical properties of MXenes - two-dimensional heterostructures provide new ideas

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MXenes represent a newly discovered class of two-dimensional layered materials, which showcase fascinating and tunable optical, chemical, and electronic properties, and exhibit diverse applications in fields such as photoelectricity, photothermal conversion, and photovoltaics.

The team of Jun He from Central South University proposed a simple and effective method for preparing Nb<sub>2</sub>C/MoS<sub>2</sub> heterostructures with enhanced both linear

and nonlinear optical properties. In this work, MoS<sub>2</sub> nanocrystals were successfully grown on the surface of Nb<sub>2</sub>C nanosheets in situ, resulting in the construction of a two-dimensional Nb<sub>2</sub>C/MoS<sub>2</sub> heterostructure. It was found that this heterostructure outperformed pure Nb<sub>2</sub>C in both linear and nonlinear optics.

The study reveals that the surface group of Nb<sub>2</sub>C can modulate the work function of Nb<sub>2</sub>C/MoS<sub>2</sub>, which affects the charge transfer and energy alignment between Nb<sub>2</sub>C and MoS<sub>2</sub>. As a result, Nb<sub>2</sub>C/MoS<sub>2</sub> inherits the advantages of Nb<sub>2</sub>C and MoS<sub>2</sub> at different wavelengths and exhibits enhanced broadband optical absorption characteristics.

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