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Titanium carbide MXenes: Advancing gas sensing applications through 2D nanostructures and functional surface engineering

Titanium carbide (Ti3C2Tx) MXenes have emerged as promising materials for gas sensing due to their unique two-dimensional structure, high surface area, metallic conductivity, and tunable surface chemistry. These properties enable efficient interaction with gas molecules, even at the physisorption level, resulting in significant shifts in electrical parameters. Unlike traditional semiconductor metal oxides, Ti3C2Tx MXenes exhibit excellent sensitivity and selectivity at room temperature (RT), reducing energy consumption and enhancing safety. In this study, Ti3C2Tx MXenes are explored for advanced gas sensing applications, focusing on their ability to detect trace levels of gases such as volatile organic compounds (VOCs) and toxic gases.
To comprehensively understand the fundamental properties of Ti3C2Tx MXenes, various characterization techniques will be employed which will assess microstructural properties such as structure and crystallinity, morphology, surface chemistry and defects properties. These analyses will interpret the relationship between structural features and gas sensing performance.
This study's highlights the potential of Ti3C2Tx MXenes as high-performance materials for advanced gas sensors, combining the advantages of 2D nanostructures and heterostructure engineering to achieve superior functionality in practical sensing environments.

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