CO2 CONVERSION

# Illuminated syngas

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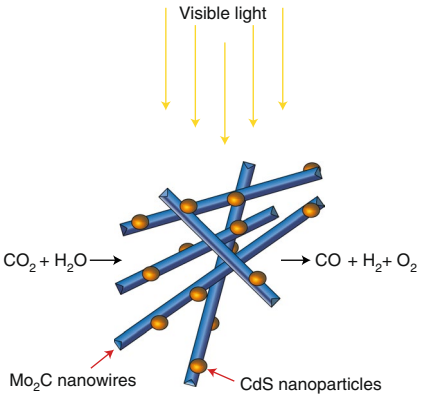


The photocatalytic conversion of $CO_2$ into CO is an ideal process to generate syngas as the crucial intermediate for the preparation of sustainable fuels via Fischer–Tropsch chemistry. However, the landscape of catalysts that can perform this step of artificial photosynthesis is dominated by noble metals, which often feature a limited activity as well as low selectivity for CO. Now, researchers at Jiao Tong University, The University of Texas at Austin and Zhejiang University reported a cadmium sulfide (CdS)-molybdenum carbide ($Mo_2C$) nanowire composite (pictured) that can evolve CO with 98% selectivity and a rate of around 30 μmol $h^{-1}$ by photocatalytic reduction of $CO_2$, surpassing the performance of a noble metal-based catalyst analogue.

The catalyst´s architecture features the use of molybdenum carbide nanowires as the support, which anchor and promote the dispersion of cadmium sulfide nanoparticles. These, in turn, function primarily as visible light absorbers, as confirmed by comparative UV–vis analysis of the composite and different reference compounds. Photoluminescence spectra as well as transient photocurrent response were further employed to confirm the crucial role of $Mo_2C$ in facilitating the separation of electrons and holes generated on CdS upon light irradiation. Moreover, gas adsorption studies followed by infrared analysis of the typical intermediates in $CO_2$ reduction revealed that $Mo_2C$ accommodates sites for both $CO_2$ adsorption and conversion on its surface.

A platinum-supported CdS composite was used as a reference catalyst for comparison. Interestingly, this catalyst features a much lower CO evolution rate and selectivity — 5.8 μmol $h^{-1}$ and 72.5%, respectively. The authors noticed that the high level of selectivity in the carbide-based catalyst is linked to its proton-related activity. In fact, CdS/$Mo_2C$ shows a relatively high $H_2$ evolution rate, suggesting that in this way protons are prevented from undergoing other competing $CO_2$ reaction pathways that usually result in the formation of hydrogen-rich carbon products — for example, $CH_4$ and $CH_3OH$.

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