Mo-doped Pt/WO_x Nanowires with Plasmonic Effect for Enhancing Photothermal CO_2 Hydrogenation under Visible-infrared Light

([1]*Graduate School of Engineering, Osaka University,* [2]*Unit of Elements Strategy Initiative for Catalysts & Batteries (ESICB), Kyoto University,* [3]*JST, PRESTO*) ○Hao Ge,[1] Yasutaka Kuwahara,[1,2,3] Kazuki Kusu,[1] Hiromi Yamashita[1,2]

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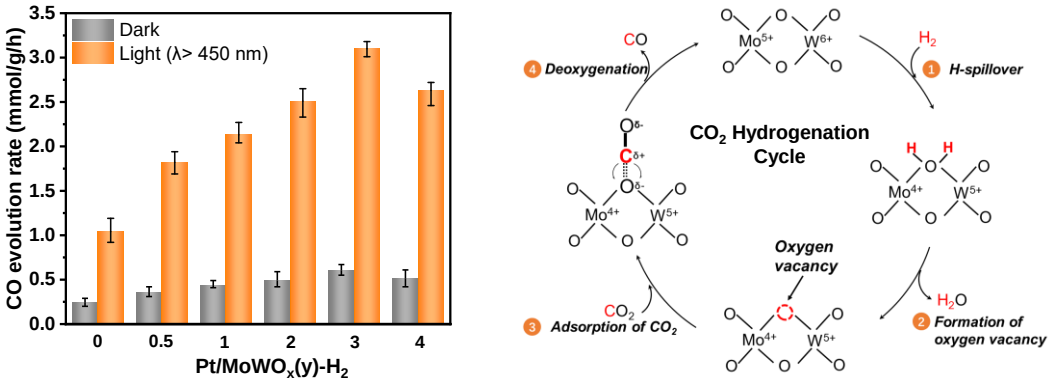
Plasmon-assisted photothermal catalytic hydrogenation of CO_2 provides an intriguing approach for realizing CO_2 reduction under mild conditions, because of the photo-induced electron-hole pairs generation and an overall increase in the localized temperature under the light irradiation.[1-2] However, the poor photothermal conversion efficiency and a lower number of photoinduced electrons are the main factors responsible for limiting the applicability of the catalyst. Doped WO_3 can present surface plasmon resonance (SPR) capabilities, which can be adjusted by changing a dopant concentration. To investigate the potential of the WO_x plasmonic effect in CO_2 reduction reaction, we herein report the Mo-doped WO_x coupled with Pt nanoparticles (Pt/$MoWO_x$) significantly boosts the photothermal hydrogenation of CO_2 to CO.

The developed Pt/$MoWO_x$ exhibits an excellent catalytic performance (3.1 mmol/h/g) in the photothermal reverse water-gas shift (RWGS) reaction at 140 °C, outperforming the un-doped Pt/WO_x (1.02 mmol/h/g). The X-ray photoelectron spectroscopy (XPS) and *in situ* X-ray absorption fine structure (XAFS) measurements revealed a reversible redox event of the Mo and W atoms during the RWGS reaction, certifying that the oxygen vacancies between Mo and W atoms in Pt/$MoWO_x$ act as active sites, and the Pt nanoparticles activate H_2 to realize the regeneration of the oxygen vacancies.[3]



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