Solar methanol production from photothermal catalytic CO_2 hydrogenation over Ru/In_2O_3 catalysts

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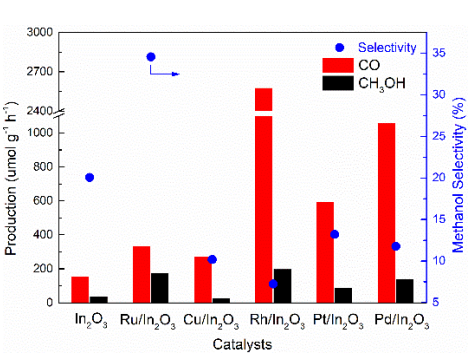
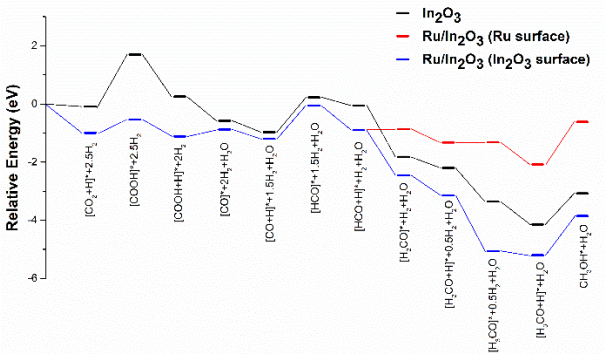
Photothermal catalytic CO_2 hydrogenation to methanol (CH_3OH) using renewable H_2 is a promising method to convert solar energy into chemical energy, contributing to the "methanol economy" proposed by George A. Olah [1]. However, it is still impeded from industrial application due to the relatively low conversion efficiency and poor selectivity under mild conditions. Among the investigation of efficient catalysts, In_2O_3 has recently been considered as a potential candidate for methanol production [2,3], yet still needing further development.

Herein, we report a Ru/In_2O_3 catalyst synthesized by a facile method for effective photothermal methanol production from CO_2 hydrogenation under atmosphere pressure. The Ru/In_2O_3 catalyst can effectively catalyze methanol synthesis while inhibit the competitive reverse water-gas shift reaction and exhibit better activity and selectivity in comparation with reported works. Mechanism studies demonstrate that the synergy of photothermal heating/conversion and light-promotion contributes to the effective methanol production, and the interaction between Ru and In_2O_3 enhances the decomposition of CO_2 and H_2 on the catalyst surface, which is confirmed by DFT calculations. This work reports a potential efficient catalyst for photothermal CO_2 hydrogenation to methanol.





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