SELECTIVE CO_2 PHOTOELECTROCHEMICAL REDUCTION TO FORMATE ON ULTRA-THIN DEFECTIVE TiO_2 FILMS

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Ultra-thin TiO_2 films with controlled defects have shown potential as efficient CO_2 photoelectrocatalysts for selective production of formate in photoelectrochemical and photochemical reactions. In this study, we prepared TiO_2 films with controlled concentration of oxygen vacancies via the sol-gel process with subsequent dip coating and investigated their performance in CO_2 reduction reactions. By controlling the thickness of the TiO_2 film and inducing controlled defects, we facilitated the charge transfer via generation of trap states that improved the efficiency of the CO_2 photoelectrochemical reduction. We also established the distinctive selectivity of heterogenous photoelectrochemical and photochemical reactions towards the formate production. Our results demonstrate the importance of careful control over the CO_2 reduction conditions, as well as TiO_2 synthetic prehistory for optimizing the performance of TiO_2 film catalysts in photoelectrochemical reduction reactions.