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Abstract View Online

CO_2 Photocatalytic Reduction over TiO_2 Nanocrystals with Coexposed {001} and {101} Facets

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Abstract

CO_2 photocatalytic reduction with water is one of the most popular and challenging technologies to produce renewable energy. Engineering TiO_2 with coexposed {001} and {101} facets could enhance the conversion efficiency of CO_2 due to the effective separation of photogenerated charges caused by the formation of {001}/{101} surface heterojunction. However, faceted TiO_2 nanocrystals still suffers from low conversion effiency and low selectivity for CO_2 reduction. Faceted TiO_2 nanocrystals were combined with graphene and metal nanoparticles respectively to improve the activity and selectivity of CO_2 photocatalytic reduction. The results show that the faceted TiO_2/graphene composites exhibited higher CO yield than that of pristine TiO_2 due to the formation of {001}/{101} surface heterojunction and supporting of graphene, which can effectively promote the spatial separation of photogenerated electrons and holes. Differing from graphene, Pt loading tended to promote the production of CH_4 and H_2 while Cu_2O suppressed H_2 evolution and exhibited lower CH_4 selectivity comparing with Pt. Furthermore, when Pt and Cu_2O were co-deposited on TiO_2 crystals, H_2 and CO production were both inhibited and CO_2 was selectively reduced to CH_4. Pt could not only capture photogenerated electrons but also increase the electrons density on the surface of TiO_2. Meanwhile, Cu_2O loading enhanced the CO_2 chemisorption on TiO_2 while inhibited that of water. As a result, Pt and Cu_2O co-deposited TiO_2 crystals exhibited high selectivity for CH_4 production.

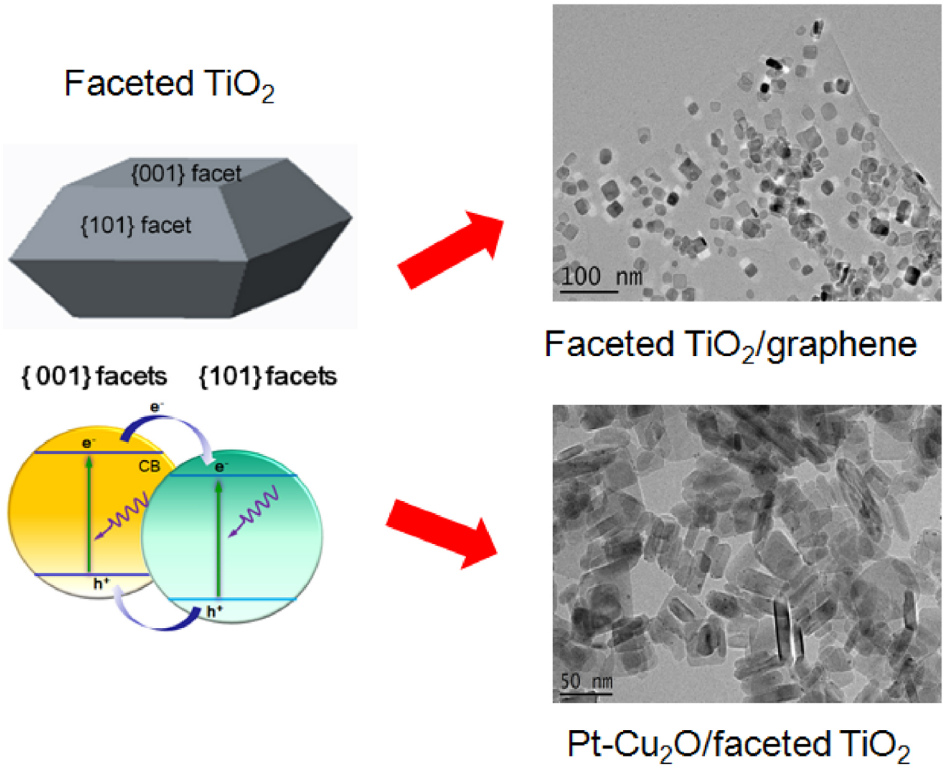

Figure 1. Schematic diagram of graphene and metal modified faceted TiO_2 nanocrystals.