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Review Article

Modified TiO_2 photocatalyst for CO_2 photocatalytic reduction: An overview

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ABSTRACT

The photocatalytic pathway to reduce carbon dioxide (CO_2) to fuel, an artificial photosynthesis process, is a futuristic and ultimate way to combat the energy crisis and CO_2 emission issues. The most widely used catalyst for photocatalytic reactions is titanium dioxide (TiO_2) due to its availability, chemical stability, low cost and resistant to corrosion. Although TiO_2 photocatalyst suffers due to its wide band gap (only can be activated under ultraviolet light irradiation) and high electron-hole recombination rate, it remained as a precursor for the development of visible light responsive materials for CO_2 reduction through different modifications, such as doping of metal, nonmetal, semiconductors etc. There is a significant improvement in CO_2 conversion using the visible light responsive TiO_2 based catalysts. The product distribution due to the photocatalytic reduction of CO_2 highly depends on the band gap and band edges of the catalyst. The understanding in the mechanistic pathway of CO_2 reduction is very important to design the catalyst for the production of desired product. This present paper provides an overview of research and development of TiO_2 based photo-catalysts for CO_2 reduction and focuses on the improvement of the photocatalyst based on the band gap engineering, charge transfer and CO_2 adsorption. Moreover, the challenges and future prospect in the developing modified TiO_2 for photocatalytic reduction of CO_2 has also been discussed.