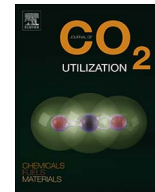


Contents lists available at [ScienceDirect](https://www.sciencedirect.com)Journal of CO₂ Utilizationjournal homepage: www.elsevier.com/locate/jcou

Review Article

Modified TiO₂ photocatalyst for CO₂ photocatalytic reduction: An overviewHamidah Abdullah^{a,b}, Md. Maksudur Rahman Khan^b, Huei Ruey Ong^b, Zahira Yaakob^{a,*}^a Department of Chemical and Process Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Bangi, Selangor, 43600, Malaysia^b Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Gambang, Kuantan, Pahang, 26300, Malaysia

ARTICLE INFO

Keywords:Carbon dioxide (CO₂)

Photocatalyst

Titanium dioxide (TiO₂)

ABSTRACT

The photocatalytic pathway to reduce carbon dioxide (CO₂) to fuel, an artificial photosynthesis process, is a futuristic and ultimate way to combat the energy crisis and CO₂ emission issues. The most widely used catalyst for photocatalytic reactions is titanium dioxide (TiO₂) due to its availability, chemical stability, low cost and resistant to corrosion. Although TiO₂ 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 CO₂ reduction through different modifications, such as doping of metal, nonmetal, semiconductors etc. There is a significant improvement in CO₂ conversion using the visible light responsive TiO₂ based catalysts. The product distribution due to the photocatalytic reduction of CO₂ highly depends on the band gap and band edges of the catalyst. The understanding in the mechanistic pathway of CO₂ 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 TiO₂ based photo-catalysts for CO₂ reduction and focuses on the improvement of the photocatalyst based on the band gap engineering, charge transfer and CO₂ adsorption. Moreover, the challenges and future prospect in the developing modified TiO₂ for photocatalytic reduction of CO₂ has also been discussed.