Titanium Based Catalyst Systems for Photo-catalytic CO_2 Reduction

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The development of facile and robust photo-catalyst to establish the photo-catalytic CO_2 reduction in industrial scale firstly would considerably reduce the amount of greenhouse gases in the atmosphere; secondly, it would found a renewable source of industrially valuable compounds like methanol, formic acid and other hydrocarbon compounds.

Ti-based compounds including TiO_2 remains to be the most robust photo-catalyst for CO_2 reduction with two main drawbacks: poor selectivity and high activation energy.[1] Incorporation of vanadium with titanium in ternary metal oxides considerably narrows the band gap energy from 3.2 eV for pure TiO_2 up to 1.7 eV for Ti-V-O ternary oxide with the increase of vanadium content, making the ternary oxide visible light active.[2] Ti-based MOFs are an ideal class of materials to apply as a catalyst for the range of photo-catalytic processes including the photo-reduction of CO_2.[3] Introduction of Ti into MOF may allow to tune the photo-responsive properties and selectivity of titanium and enhance other properties of the catalyst as the porosity and stability by changing the organic counterpart.

Herein we report on $Ti_xV_yO_z$ and new type Ti-MOF composites obtained by incorporation of Ti ions with H3BTC and its photo-catalytic properties. The obtained composites were characterized by XRD, TEM, SEM, BET and TGA. The CO_2 conversion rate was also studied by changing reaction parameters such as UV wavelengths, gas flow rate, etc.

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