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Novel $W_{18}O_{49}$ - TiO_2 Materials for Solar Fuel Production from CO_2 Photoreduction

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Artificial photosynthesis has attracted wide interest in mitigating the atmospheric greenhouse gas, CO_2 , as well as in generating solar fuels. However, materials with oxygen-vacancy-rich have not been much explored for CO_2 photoreduction, despite their intrinsic advantages, including change of gas adsorption capability, optical properties and electronic structures.^[1]

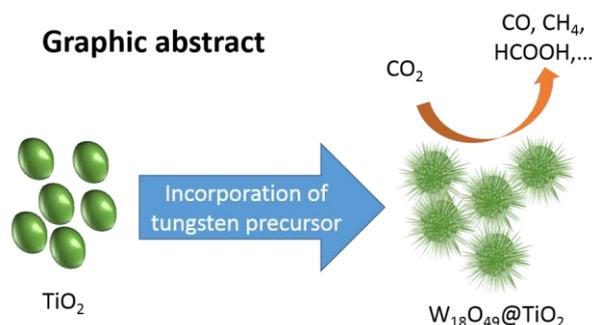
Oxygen-vacancy-rich $W_{18}O_{49}$ was previously used for the photochemical reduction of CO_2 and showed 95% selectivity towards CH_4 under visible light irradiation in the absence of co-catalyst. Moreover, core-shell compounds have been shown to improve the light absorption, generation and separation of electron-hole pairs for various photocatalytic processes.^[2] Therefore, the aim of this work is to develop $W_{18}O_{49}$ anchored on the surface of TiO_2 nano-peas in order to optimize selectivity towards different hydrocarbons, such as CO , $HCOOH$, etc.

The synthesized TiO_2 nano-peas were highly crystallized, with anatase phase as shown in the XRD pattern. When the $W_{18}O_{49}$ was incorporated onto TiO_2 nano-peas, sea urchin-like nanoparticles were obtained. The composite TiO_2 - $W_{18}O_{49}$ materials were characterised using Raman, XPS, FTIR and UV-vis. The CO_2 photoreduction efficiency and product selectivity were significantly affected by the surface coverage of $W_{18}O_{49}$ on the TiO_2 nano-peas. In conclusion, the proposed core-shell semiconductor composites have offered an alternative to tailor photocatalysts as well as to avoid the use of the previous metal co-catalyst, such as Pt.

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References

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