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ABSTRACT

Multifunctional materials for solar fuels production by artificial photosynthesis

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An interesting route for the valorization of CO_2 consists on its photo(electro)catalytic conversion into sustainable fuels and/or chemicals; this process is known as Artificial Photosynthesis. This is a quite challenging process since CO_2 is a stable compound and its reduction involves a series of multi-electron reactions. Several strategies are carried out to improve de photocatalytic efficiency and to control the selectivity. The modification of optoelectronic properties of through the use of band gap engineering strategies, allow controlling the absorption of photons, redox capabilities and subsequently the photocatalytic performance. Metal nanoparticles act as electron scavenger and as co-catalyst. The use of novel hole transport materials such as conjugated porous polymers maximize the light harvest and charge separation.

Many efforts must be devoted to shed light on mechanistic aspects of the reaction to clarify the effect of parallel and competitive reactions in the activity and products distribution, through the use of a combination of operando techniques and theoretical calculations.

To achieve a successful solar fuel production, it is necessary to tackle the challenge in a holistic manner identifying and solving the barriers to large-scale development. In this sense, it is crucial to advance on the scale up of photocatalytic materials and devices that allow a future industrial development.

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