

*Unravelling the photoredox pathways in CO<sub>2</sub> photoreduction by artificial photosynthesis*

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Photocatalytic solar-energy conversion for energetic and environmental applications is one of the most important challenges of this century. An interesting route for the valorization of CO<sub>2</sub> and H<sub>2</sub> production consists on its photocatalytic conversion into fuels and/or chemicals in the presence of water and suited photocatalysts; this process is also known as Artificial Photosynthesis (AP). Extensive efforts are focused on improving the photocatalytic efficiencies, especially when using water as the electron donor. The design and development of efficient, robust and low cost light harvesting materials is crucial in the achievement industrially competitive photocatalysts. Nonetheless, the structural and optoelectronic nature of these materials, both fundamental and excited states, and the role that they play in combination with reaction intermediates within the photocatalytic mechanism remains unclear [1].

In this work we report different strategies and modifications photocatalysts to increase process performance. Extensive efforts using operando characterization (NAP-XPS, XAS, Raman, DRIFT, photoelectrochemistry) combined with Transient absorption spectroscopy measurements and theoretical calculations are devoted to shed light on mechanistic aspects of the reaction including CO<sub>2</sub> activation, intermediates and product formation. The knowledge gain in these studies will allow developing more efficient photocatalysts with improve quantum yields and control selectivity [2].

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2. L. Collado, A. Reynal, J.M. Coronado, D.P. Serrano, J.R. Durrant, V.A. de la Peña O'Shea, *Appl. Catal. B: Environ.* 178 (2015) 177.

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