

# MATERIALS SCIENCE AND TECHNOLOGY

## Innovative photocatalysts to exploit sunlight

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<b>Context of the research activity</b>	Innovative photocatalysts will be obtained to efficiently exploit solar light to fight climate change and promote a safer environment by CO <sub>2</sub> photoreduction and removal of emerging contaminants from water.
<b>Objectives</b>	The research will deal with the synthesis, characterization, and study of the photocatalytic activity of innovative photocatalyst properly engineered to be able to exploit efficiently solar light in environmental applications, like CO <sub>2</sub> reduction and water pollutants removal. The photocatalyst will be based on undoped and doped TiO <sub>2</sub> , in the presence of QDs and other TTA (Triplet-Triplet Annihilation systems) and/or plasmonic NPs (Au, Ag, Cu) to obtain systems capable of upconversion and of plasmonic effects. Different advanced synthesis approaches will be adopted in order to control the type of TiO <sub>2</sub> polymorphic phases, the effect of doping and of QDs and plasmonic NPs on the photocatalytic performance. The synthesized nanomaterials will be deeply characterized by physico-chemical techniques in order to unravel the properties ruling the photocatalytic activity, including types of phases, surface area, morphology, bandgap energy, surface charge, surface functionalities, etc. The nanomaterials will be tested for two applications, the reduction of CO <sub>2</sub> and the removal of water emerging contaminants. The objectives are to obtain photocatalyst capable to exploit efficiently solar light,

by increasing the range of absorbed light, by stabilizing the photogenerated electron/hole pairs, by upconverting IR and Vis light to Vis and UV light, by exploiting plasmonic effects that may occur in the presence of metal nanoparticles. The study will require a period of secondment abroad of minimum six months, thanks to ongoing collaborations with the University of Palma de Mallorca (Spain) and the Massachusetts Institute of Technology (US).

**Skills and competencies for the development of the activity**

The candidate should have expertise in introductory chemistry and physics (or materials science), environmental chemistry, and possibly in the field of catalysis and of photocatalysis. The candidate should be a motivated person, keen on working in team.