Research project and activity plan

Copper Indium sulfide quantum dots appended with photoactive molecules

The research project will be aimed at the design and synthesis of photoactive molecules and quantum dots and their integration for the conversion of solar energy into chemical energy. This research is funded by the National project PRIN SUN-SPOT (2022JA3PSC).

The photoactive systems will be designed to have the following properties: (i) absorption in the required spectral range with large molar absorption coefficient; (ii) photostability under the investigated reaction conditions; (iii) lifetime of the photoreactive excited state optimised for energy and/or electron transfer processes occurring within hybrid supramolecular structures or in dynamic processes. Within this project, both molecular and nanomaterials will be investigated. For example, hybrid nanomaterials based on Copper Indium Sulfide Quantum Dots (CIS QDs) and molecular catalysts will be prepared and tested as photoactive systems for the conversion and storage of solar energy into added-value chemicals and energy rich species (solar fuels).

The selected photoactive molecules and materials will be characterised from the structural, photophysical and electrochemical point of view. The photophysical properties will be studied by steady-state and time-resolved techniques in the ultraviolet, visible and near infrared spectral region; the electrochemical characterisation will be mainly based on cyclic voltammetry with conventional and ultramicroelectrodes and it will be accompanied by spectroelectrochemical investigations. The project will be carried out in collaboration with the University of Messina (Prof. Fausto Puntoriero) for ultrafast time-resolved absorption spectroscopy and Ferrara (Prof. Stefano Carli) for the photoelectrochemical characterisation.

The candidate will design the synthetic strategy, the photochemical and electrochemical experiments and will carry out a bibliographic search to keep updated with the recent developments in the field.