NITROGEN-LIGHT - Photo(electro)catalytic Nitrogen Fixation

Light-driven nitrogen fixation is a dream goal to counteract the massive exploitation of fossil fuels currently used to convert molecular nitrogen into ammonia. The EU-funded NITROGEN-LIGHT project plans to develop innovative catalysts for the photoelectrolytic production of ammonia using nitrogen as primary source. Researchers will design multi-redox catalysts for nitrogen activation immobilised on photoelectrodes using semiconductor surfaces as photosensitisers. Merging surface science with molecular catalysis will enable the tuning of the catalyst active sites and the stabilisation of the nitrogen-derived intermediates. The project work will be instrumental in fabricating novel photocathodes for nitrogen reduction and photoanodes for water oxidation to be integrated in the whole photoelectrochemical cell design.

Despite the intensive effort on nitrogen photofixation, there is a clear gap in the design of the catalytic system at the molecular/atomic level: at the same time, the majority of literature examples for nitrogen photo(electro)reduction employed only Uv-Vis semiconductor based systems with poor control on the molecular aspects of photo(electro)catalysis. NITROGEN-LIGHT lies in the panorama of nitrogen reduction, but offering a new point of view. This project aims to develop a photoelectrolyser to efficiently convert nitrogen to ammonia, but exploiting semiconductor surfaces decorated with controlled molecular assemblies of visible-light sensitisers and nitrogen-activating multi-redox catalysts. The advantage of the molecular design is the possibility to easily tune the redox properties of active sites and the stabilization of nitrogen-derived intermediates, with the final aim of: syncronizing photo-induced electron/proton transfer (PCET), lowering the energy barrier and optimizing the quantum efficiency. Success in this task will be instrumental for the fabrication of novel photocathodes for N2RR, to be integrated within a PEC device, in combination with photoanodes for water oxidation. The photoelectrode assembly for the final device will build on the state-of-the-art expertise and recent achievements of the CalTech and the Padova group, while frontier studies on the photophysics of selected molecular assemblies, to be performed with secondment visits at the Prague Institute, will guide the overall component choice and synthetic modification.

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Find out more: **https://cordis.europa.eu/project/id/894986**