Project Number: 101064765

Project Number: SOLAR-CAT

Project title: Solar driven CO_2 reduction and alcohol oxidation without sacrificial reagent

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Abstract

Fossil fuels are our primary energy sources; however, their combustion causes climate change due to the production of greenhouse gases such as carbon dioxide (CO_2). A key solution to climate change is the direct solar-powered production of fuels from CO_2. SOLAR-CAT links the conversion of CO2 into high value chemicals with the oxidation of biomass derivatives. This project aims to develop photocatalytic systems that will operate in aqueous media without any sacrificial reagent utilizing only earth abundant chemicals. The developed dye-sensitized photocatalytic systems (DSPs) will contain cobalt complexes of quaterpyridine and 2,2,6,6-tetramethyl-1-piperidine N-oxyl (TEMPO) derivatives as catalysts for CO2 reduction and biomass oxidation, respectively.
During the first part of the fellowship, under the supervision of Dr. Fabrice Odobel (Centre National de Recherche Scientifique, CNRS), the fellow will be trained in alcohol oxidation, photo-induced electron transfer, and the development of dye-sensitized systems. During his secondment at University of Paris (UP), he will be trained by Prof. Marc Robert's research group in electrochemistry, CO2 catalysis and surface chemistry. The fellow's experience in photocatalysis, molecular synthesis, and DSP development will provide a unique opportunity for the host group to apply their knowledge in DSPs to simultaneous photo-induced CO2 reduction and alcohol oxidation. SOLAR-CAT is a highly inter- and multi-disciplinary project as it brings together the fields of molecular synthesis, catalysis, material sciences, electro- and photo-chemistry, and analytical chemistry. This project will enable the transition of the fellow from recognized researcher (R2) to an established researcher (R3) reaching his career goal (tenure track position in academia), throughout the scientific and personal training actions, the development of his transferable skills, the coordination and the management of the project.

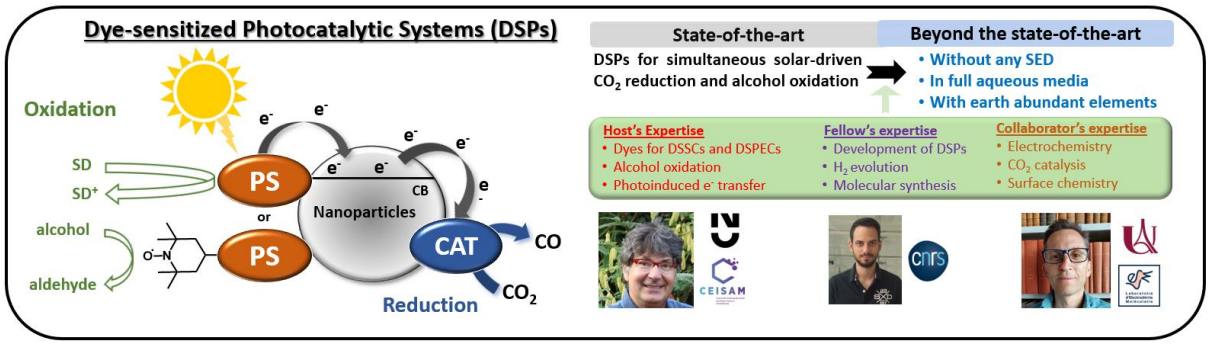
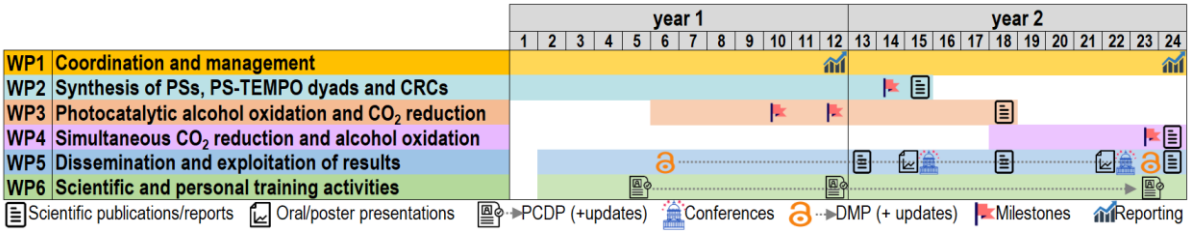


Figure 1. Working mechanism of the DSPs (left part), and state-of-the-art and expertise of all participants (right part) in SOLAR-CAT.

The proposed duration of SOLAR-CAT is 24 months. As illustrated in the **Gantt Chart** below, the project is organized into 6 Packages (WPs). WP1 includes the coordination and management activities of Dr. F. Odobel and Dr. V. Nikolaou (2 PMs). WP2 will start at the beginning of the fellowship and last for 15 months (WP2, 7 PMs of VN). WP3 (7 PM of VN) will overlap with WP2 in order to optimize the catalytic activity and the stability by synthetic modifications. The fabrication of the final DSPs (WP4, 5 PMs of VN) as well a part of WP3 will be conducted at UP (secondment). WP5 (Dr. VN 3 PMs) and WP6 (PMs included in WP 3,4) will start at the 2nd month and last until the completion of SOLAR-CAT. All the issues that might be encountered have already been considered in the timetable.

Gantt chart



List of major deliverables and milestones

* D = Deliverable; M = Milestone; R = Report; O = Other; # Date = *Measured in months from the project start date (month 1).*

D	Deliverable name	WP	Date*	Type
D1.1	Data management plan	WP1	M6-M23	Report
D1.2	Periodic project reports	WP1	M12-M24	Report
D2.1	Report on preparation and characterization for all compounds	WP2	M15	Report
D3.1	Report on photocatalytic properties of the PS-TEMPO dyads and CRCs	WP3	M18	Report
D4.1	Report on photocatalytic DSPs for CO_2 reduction and alcohol oxidation	WP4	M24	Report
D5.1	Publications in high ranking international journals	WP5	M13-M18-M24	Other
D5.2	Presentations (oral and poster) at international conferences	WP5	M15-M22	Other
D6.1	PCDP: Personal career development plan (and yearly updates)	WP6	M5-M12-M23	Other
M	**Milestone name**	**WP**	**Date**	**Verification**
M2.1	Successful preparation and characterization of all proposed compounds	WP2	M14	Materials in hand
M3.1	Identification of stable anchoring groups for long time operation	WP3	M10	Stability tests
M3.2	Successful fabrication of a DSP for H_2 evolution without SD	WP3	M12	Photocatalytic measurements
M4.1	Successful fabrication of efficient DSP for CO_2 reduction and alcohol oxidation	WP4	M23	Photocatalytic measurements

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