OVERVIEW

The Martí i Franquès Cofund Doctoral Fellowship Programme (MFP COFUND Programme) offers 3-year working contracts with all benefits attached. These contracts include **high level interdisciplinary, inter-sectorial, and international training with personalized career development plans involving soft-skills training, secondments and mentoring**. Over 50 partner organisations actively support this programme.

THE MFP-COFUND PROGRAMME OFFERS

- One of the best salaries at PhD level in Europe. Gross monthly salary of approximately 2.200€. Apart from the salary, URV will contribute up to 7.500€ each year to the cost of the fellow's travel, research and training.
- 3-6 months secondments at international (and in some cases intersectoral) partner organisations.
- An international environment, supported by the adherence to the European Charter & Code.
- Enrolment in excellent PhD programmes.
- Opportunity to do research in one of the top 500 universities in the world (76 in THE Young universities ranking).
- Access to high-quality infrastructures for research & innovation.
- Gender balanced, Open, Transparent and Merit based Recruitment.
- Equal opportunities for all.

Position description	
Title of the research project	Light-driven transformation of carbon dioxide into fuels and chemicals
Keywords	renewable fuels; photocatalysis
Research line	Carbon dioxide valorisation
PhD Programme	Nanoscience, Materials and Chemical Engineering
Reference	2020MFP-COFUND-26

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 945413

DESCRIPTION OF THE RESEARCH PROJECT

The main motivation of this project is the utilisation and **storage of sunlight** via **photo(electro)catalysis** to **transform carbon dioxide** under mild conditions of temperature and pressure into **versatile energetic chemicals** (fuels) such as formic acid or methanol, able to be stored for a virtually unlimited time.

Inspired in natural photosynthesis, which relies on impressively precise and sophisticated biomolecular mechanisms to channel the necessary energy and atom transfer processes, this project proposes to employ recyclable chemical species to assist as electron donors in the photo-reduction of CO_2, and to explore favourable photocatalytic or photoelectrocatalytic systems for the production of carbon-based fuels such as formic acid or methanol.

Photoelectrocatalytic experiments will be designed and performed, aiming at enhancing CO_2 reduction efficiency. Photoelectrodes (photocathodes) based on **Earth-abundant elements**, chiefly copper, zinc or iron, will be systematically prepared and tested. Once the best performing materials will be identified, photoelectrochemical cells for full-process CO_2 reduction will be constructed using state-of-the-art anodes for the concomitant conversion of electron donors. Ultimately, in order to assess the possibility of wireless operation without the need for external electricity, photocatalytic experiments will be also carried out.

Regarding possible electron donors, their transformation into valuable coproducts will be sought. In this regard, the following classes of chemicals will be tested:
1. Halides, especially chloride, aiming at the production of chlorine or hypochlorite.
2. Inorganic or organic sulphides, which could result in production of elemental sulphur or polysulfides.
3. Biomass-derived oxygenates, among which alcohols and aldehydes may serve as models for artificial CO_2 fixation towards more chemically complex structures.

Critical evaluation will be finally performed by estimating the productivity of the designed photoelectrochemical cells for fuel production under real-life, ideally **natural sunlight**, conditions. Sensitive parameters such as solar-to-fuel energy efficiency, or production costs, may be estimated as indicators for technology feasibility.

REQUIRED PROFILE

– **BSc** and **MSc** levels within **Chemistry**-related education programmes.
– Candidates must have **300+ ECTS academic credits** during their BSc and MSc degrees.

CONTACT DETAILS

Management team:
MFP-COFUND website; mfp.cofund@urv.cat

PhD thesis supervisors:
Alberto Puga alberto.puga@urv.cat
Ricard Garcia-Valls ricard.garcia@urv.cat

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 945413