MSCA Postdoctoral Fellowships

HORIZON MSCA 2024 PF

Expression of interest

5th of July 2024

Deadline for submission of documents

instituto IMdea energía

EXCELENCIA MARÍA DE MAEZTU

Contact Person/ Scientist in charge

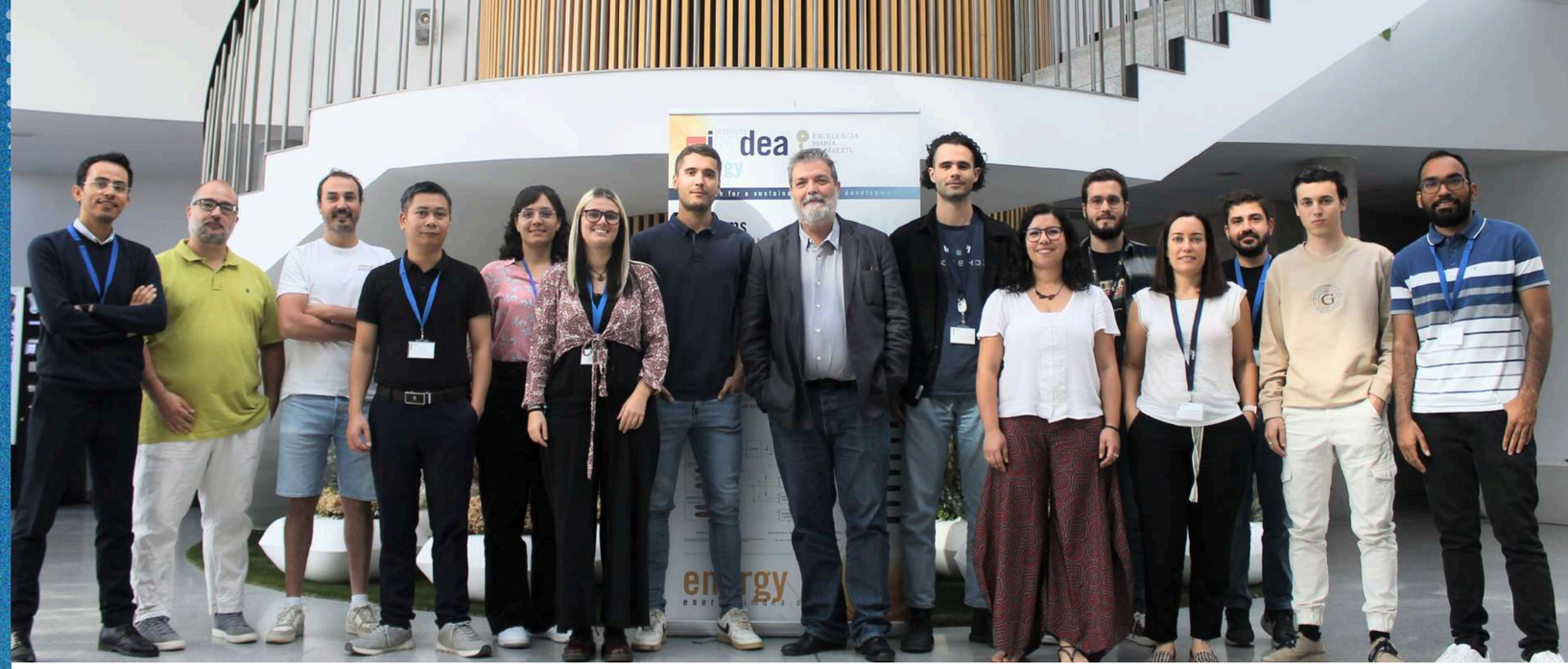
Javier Dufour, Head of Unit javier.dufour@imdea.org

Brief description of the Research Group

The Systems Analysis Unit of IMDEA Energy, http://www.energy.imdea.org, specializes in assessing the technical, economic, environmental and social performance of energy systems. To that end, the unit has developed strong capabilities and has a sound expertise in (i) modelling, simulation and exergy and economic analysis of energy production systems on biofuels, renewables, hydrogen, etc., and analysis of their integration into circular economy strategies and policies, (ii) life cycle sustainabilityassessment, multicriteria decision analysis and eco-design of energy systems, and (iii) prospective analysis through energy systems modelling and scenario analysis for sustainability-oriented energy planning, having developed a regional model for Madrid and a Spanish national model for power generation and road transportation fuel production.

Applications

If interested, please, send an e-mail to javier.dufour@imdea.org, indicating your main research interests and attaching a CV and two reference letters, before 5th of July 2024.



Project description

Our unit is seeking a candidate to join a multidisciplinary team for the development and application of new frameworks for modeling and optimization of energy systems. The specific objectives of the project are:

- Research and development in the field of Energy Systems Analysis.
- R&D on hydrogen systems modeling and sustainability assessment.

The candidate should have a strong knowledge of hydrogen production (alkaline, PEM, AEM, SO electrolysers) and use (fuel cells) systems, and understanding of sustainability problems associated with hydrogen systems, and a good overview of energy policies at the European level. The ideal candidate would have a PhD degree in engineering disciplines. Proficiency in life cycle thinking tools and eco-design is an asset.

Research Area

- Information Science and Engineering (ENG)
- Environmental and Geosciences (ENV)

Contact Person/ Scientist in charge

Elia Tomás elia.tomas@imdea.org

Brief description of the Research Group

The Biotechnological Processes Unit (BTPU) focuses its research lines on several biochemical technologies based on microorganisms to produce sustainable solutions in the form of biofuels and biochemicals.

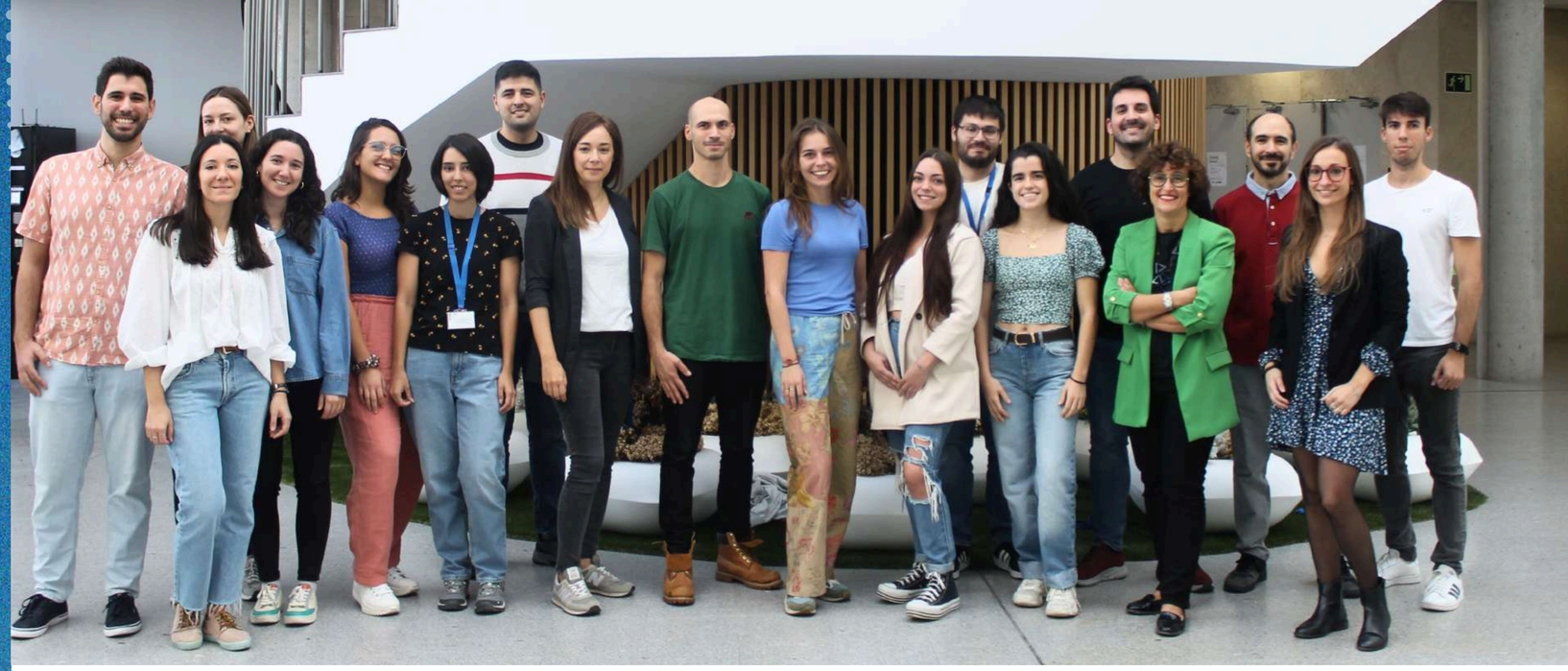
Research Area

Chemistry (CHE)
Environmental Sciences and Geology (ENV)
Life Sciences (LIF)

Applications

Deadline for submission of documents 5th of July 2024. Documents to be submitted:

- Complete curriculum vitae stating background and skills
- Letter of motivation including research interests
- Two reference letters



Project description

Yeasts are versatile and interesting cell factories for bioproducts generation from residual carbon sources. Within this context, microbial oils or single cell proteins synthetized in microorganisms and produced from wastes are a feasible alternative for a progressive fossil fuels reduction. Conventionally, sugar-based feedstocks are used in yeast biotechnology however this limits the process to carbohydrate rich substrates. The sugar platform can be substituted by a SCFAs (carboxylate)-based technology which enables bioprocess flexibility upon different substrates while opening the range of utilized molecules. In this context, the fellow will be involved in the development of efficient yeast strains for SCFAs valorization towards different bioproducts.
The postdoctoral fellow is expected to work on the study of fundamental aspects of yeasts metabolism in order to increase the knowledge of this innovative approach and the long-term exploitability of bioprocesses combination. The fellow will also study different fermentation routes for producing lipids and proteins with non-conventional yeasts.

Yeast molecular biology will be valued since different molecular tools will be use for the development and generation of new yeast strains.

Contact Person/ Scientist in charge

Jesús Palma & Rebeca Marcilla
jesus.palma@imdea.org / rebeca.marcilla@imdea.org

Brief description of the Research Group

One of the main targets of the Electrochemical Processes Unit (ECPU) is to provide new concepts and technological alternatives for electrochemical energy storage. The energy storage systems developed by the ECPU are designed to be applicable to renewable energies, electrification of transport and the emerging nexus between water and energy. The research programme focuses on how newer materials and designs may improve the performance of these systems and on the application of electrochemical storage systems to renewable power generation systems, sustainable buildings and electric vehicles.

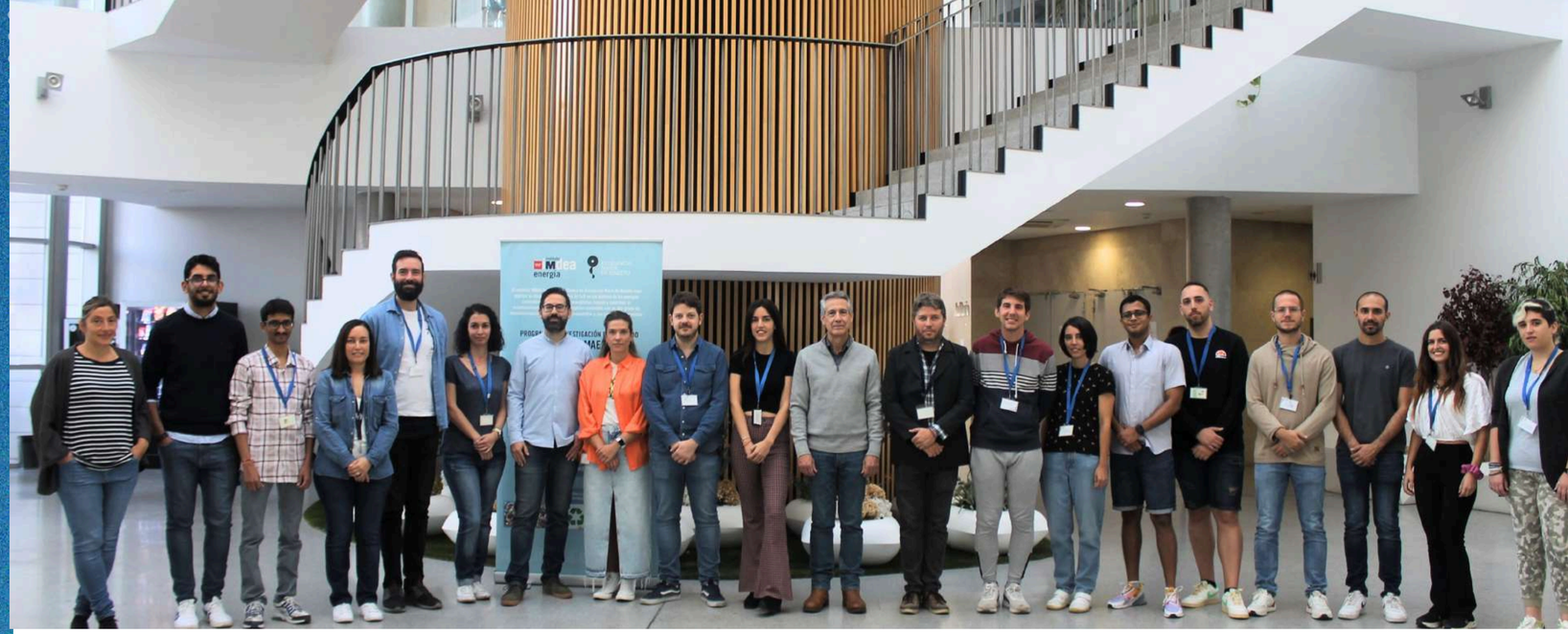
Research Area

- Chemistry (CHE)
- Information Science and Engineering (ENG)
- Environmental and Geosciences (ENV)
- Physics (PHY)

Applications

Deadline for submission of documents 5th of July 2024. Documents to be submitted:

- Complete curriculum vitae stating background and skills
- Letter of motivation including research interests



Project description

The MSCA Postdoctoral fellow will join an interdisciplinary group of researchers – chemists, physicists and engineers – aiming to generate novel concepts, materials and devices for electrochemical energy storage. The fellow will be involved in some of the following research lines being currently addressed at ECPU:

Redox Flow Batteries

- Organic or organometallic based electrolytes for high energy density, low-cost and sustainable RFBs
- Membrane-free concepts: immiscible electrolytes and microfluidic RFBs
- Solar-rechargeable RFB

Metal-air (Zn-air, etc)

- Electrodes, electrolytes and electrocatalysts for lower cost and increased performance

Metal-ion Batteries (Li-ion or multivalent batteries)

- New organic or inorganic electrodes and electrolytes for Li-ion or multivalent batteries
- Advanced In-situ/operando characterization techniques
- Li-ion battery recycling

Battery testing and modelling

- New methodologies for accelerated testing of batteries.
- Prediction models to estimate the state of health of batteries.
- o Multiscale / Multiphysics Modelling applied to battery design

Efficient Electrochemical Water Treatment:

- Water deionization (capacitive or faradaic)
- Water electro-oxidation

Computational Chemistry: electronic structure calculations (Density Functional Theory, Wave Function Theory, Molecular Dynamics)

Contact Person/ Scientist in charge

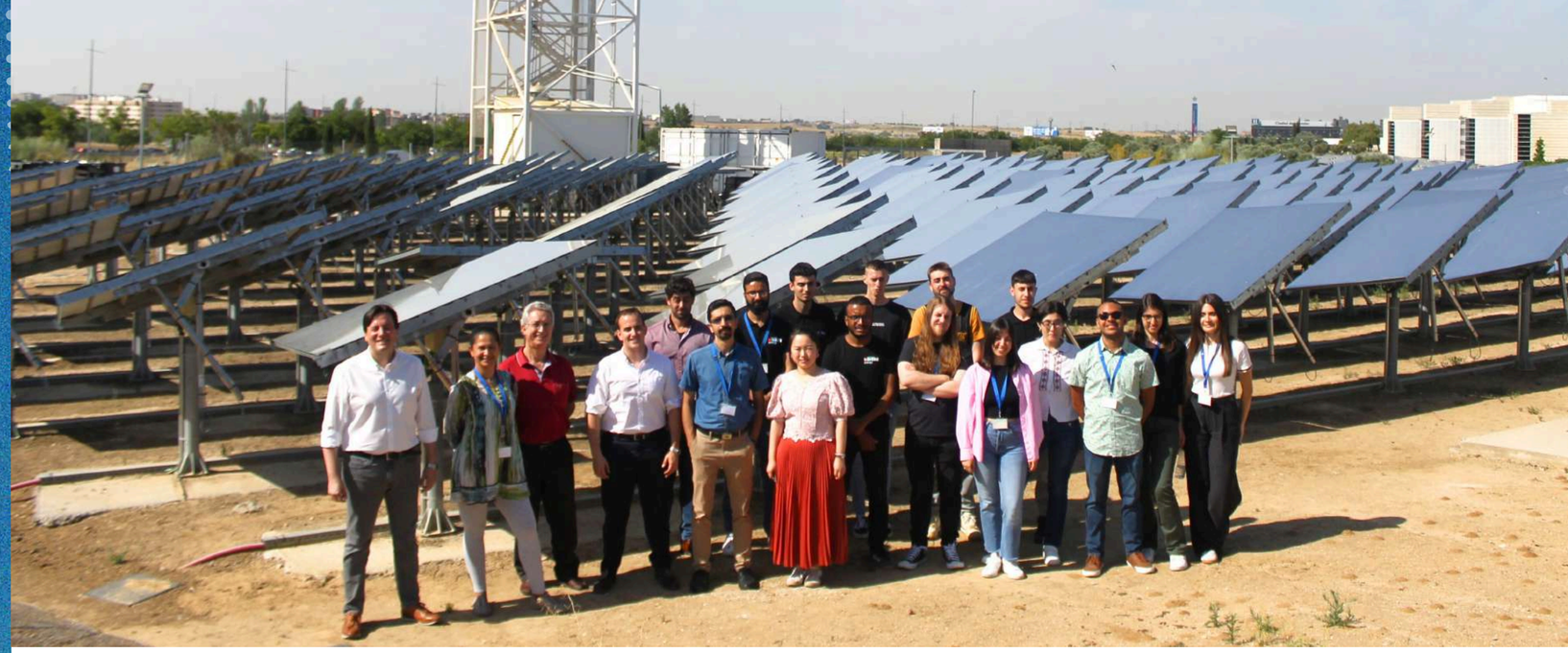
José González Aguilar jose.gonzalez@imdea.org

Brief description of the Research Group

The R&D unit of High Temperature Processes (HTPU) of IMDEA Energy aims at developing modular, efficient, dispatchable and cost-effective high temperature technologies based on concentrating solar energy for synthesis of solar fuels and chemicals, heat and electricity generation.

Activities on concentrated solar energy target significant improvement of global profitability of solar thermal technologies and increase its contribution in the primary energy consumption and comprise the development of innovative and high-efficient components (solar concentrators, receivers, reactors, and thermal storage modules), the elaboration of testing procedures and measurement techniques under high solar radiation fluxes and/or high temperature, and the design of advanced solar power plants able to create more efficient and modular schemes of hybridization or solar stand-alone systems with heat storage. Besides emerging concepts based on direct solar energy conversion systems replacing current use of thermodynamic cycles are also explored.

The HTPU R&D is supported by singular technical and scientific infrastructure like 4kWe and 42kWe-high-flux solar simulators and a 250kW high-concentration solar tower, a laboratory equipped with instruments for materials synthesis and characterization under high-flux and high-temperature and software and hardware for numerical modelling and simulation.



Project description

The fellow will be mainly involved in the development of direct and chemical solar energy conversion technologies applied to solar thermal power plants using Central Receiver Systems, with operation temperatures in the range of 600 to 1,500 ºC. The project may address technologies for electricity and/or chemicals synthesis. Thermoelectric converters, TPV (thermal photovoltaics), thermionic energy conversion, solar thermo-electrochemical and thermo-catalytic reactors, high-temperature electrolyzers and fuel cells and other. Systems may use solarized modules directly irradiated or indirectly heated through heat exchangers. The project may involve materials design using computational chemistry and artificial intelligence tools, materials synthesis and characterization, experimental research at lab-scale by developing small modules from 0.1 up to 10 kW to be tested with solar simulators, numerical analysis using Computational Fluid Dynamics tools and flowsheeting and system analysis with suitable software to analyze integration and performance in commercial plants

Research Area

- Chemistry (CHE)
- Information Science and Engineering (ENG)
- Mathematics (MAT)
- Physics (PHY)

Applications

Deadline for submission of documents 5th of July 2024. Documents to be submitted:

- Complete curriculum vitae stating background and skills
- Letter of motivation including research interests
- Two reference letters

Contact Person/ Scientist in charge

Víctor A. de la Peña O'Shea & Marta Liras.
victor.delapenya@imdea.org / marta.liras@imdea.org

Brief description of the Research Group

The main activity of the Photoactivated Processes Unit (PAPU) is the development of light-activated materials and processes for the production of sustainable fuels and other applications of interest in energy and environment. More precisely, our interest is focused on the development of devices and photoreactors, as well as in the design, synthesis and operando characterization of multifunctional materials, based on organic (conjugated polymers), inorganic (band gap engineering) and hybrid (heterojunctions and organo-inorganic coordination polymers) semiconductors, with photocatalytic activity for the production of fuels as a way for sustainable generation and storage of energy.

Research Area

- Chemistry (CHE)
- Information Science and Engineering (ENG)
- Physics (PHY)
- Data Scientist (ENG)

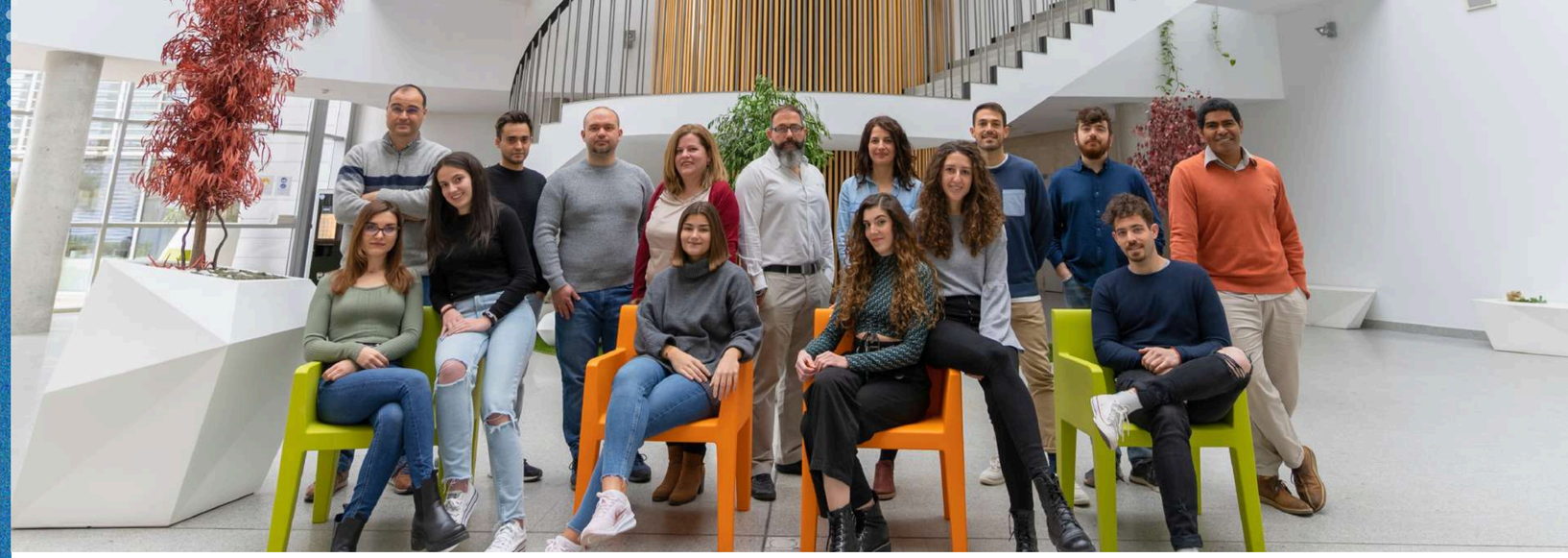
Applications

Demonstrated experience:

- MOFS and COFs: Synthesis and characterization and structural determination using single crystal and powder diffraction.
- Conductive polymers: Synthesis and characterization of conductive organic polymers; Photocatalysis or photoelectrochemistry.
- Characterization and theoretical studies: In-situ characterization, including synchrotron radiation (XRD, HP-XPS, XAS); Atomic modelling and use of theoretical calculation software.
- Reactor engineering: Photocatalytic, photoelectrocatalytic or solar reactor design and operation; Process control tools; Chromatographic analytical techniques.
- Development of Machine Learning algorithms.
- Knowledge on the development of automatization environments for material synthesis.

Deadline for submission of documents: 5th of July 2024.
Documents to be submitted:
CV stating background and skills

- Letter of motivation including research interests
- Two reference letters



Project description

The postdoctoral fellow is expected to be involved in the development of hybrid materials for photocatalytic and photoelectrocatalytic reactions of energy and environmental interest, and proposed MSCA project may include the activities in one of the three research lines at the PAPU:

Synthesis and characterization of MOF, COF materials or conjugated organic conductive polymers (CPPs)
Synthesis of MOFs, COFs or CPPs for photocatalytic and photoelectrochemical applications.
Chemical, electrochemical, functional and optoelectronic characterization of those polymers and hybrid materials.
Application in photocatalytic reactors and photoelectrochemical cells.

Advanced experimental and theoretical characterization tools
Characterization studies of different kinds of hybrid materials by standard characterization techniques.
Design, construction and use of devices for operando characterization in photocatalytic and photoelectrochemical reactions.
Theoretical studies of the structural and opto-electronic properties of hybrid materials.

Photocatalytic and photoelectrocatalytic reactor engineering
Design and set-up of photochemical and photoelectrochemical reactors for use under solar irradiation and artificial light.
Development of applications for process control in photochemical and photoelectrochemical reactors.
Operation of photochemical and photoelectrochemical reactors, including the development of analytical methods for the assessment of reaction products.

Development of artificial intelligence tools for synthesis of materials and testing on solar Fuels
Design and set-up of machine learning algorithms for managing information of database
Creation of an ontology for Solar fuels and chemical processes.
Development of applications for robotization of synthesis process and control in photoelectrochemical devices

Contact Person/ Scientist in charge

Milan Prodanovic milan.prodanovic@imdea.org

Brief description of the Research Group

The principal activity of the Electrical Systems Unit is the development of intelligent algorithms for management of future electricity networks and energy systems. To achieve the necessary high levels of energy system flexibility, efficient and sustainable solutions are sought in integration of energy storage devices and renewable energy sources as well as in application of centralized and distributed control methods. Smartgrids, energy efficiency (smart buildings), grid forming, operation, stability and control of electricity networks and low-inertia power systems, are commonly used to describe the research interests of the unit.

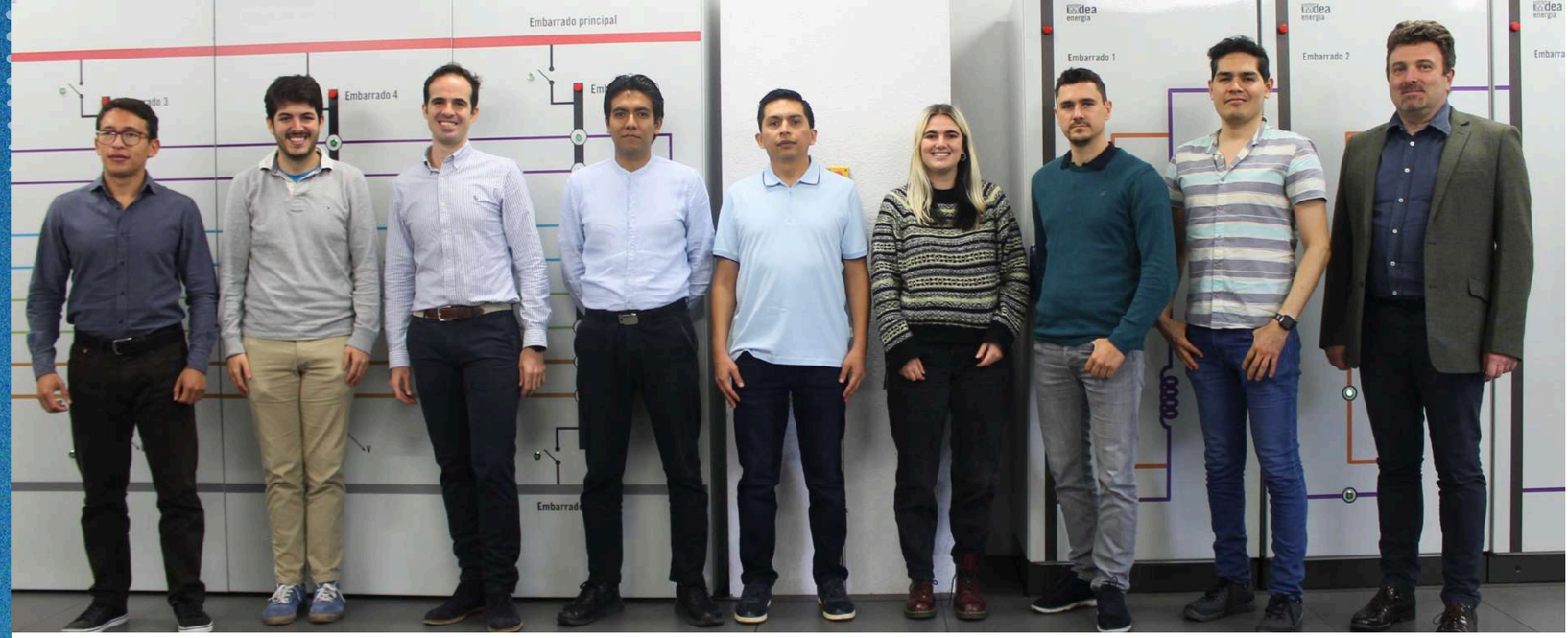
Research Area

Information Science and Engineering (ENG)

Applications

Deadline for submission of documents 5th of July 2024. Documents to be submitted:

- Brief outline of the proposed research project (2 pages maximum)
- Complete curriculum vitae stating background and skills + two reference letters



Project description

The project can be presented in one of the following research lines:

Ancillary services in future power networks

The objective of this line is techno-economic-environmental evaluation of new services developed for grid operators (TSOs and DSOs) and providing assistance in creating future grid regulation. Assigning the value to “grid-forming” and other balancing services offered by power converters in future grids. Frequency and inertial response services as well as damping of frequency and sub-synchronous oscillations are of particular interest. Aggregation of different sources and, more specifically, the services provided by Dynamic Virtual Power Plants are studied. Exploring the role of demand control schemes in the grid services is of interest as well.

Optimal design and management of energy systems

Energy system management, their coordination and integration to power grids are all of increased importance to this research unit. Holistic approach is used for modelling demand and generation in energy systems and creation of their Digital Twins. Options for renewable and storage device integration are sought in order to improve energy system autonomy and increase its self-consumption. Finally, real-time optimal energy resource management techniques, based on advanced prediction algorithms and aiming at the minimisation of operational costs are under development.

Power electronics interfaces for future power networks

The research activities include development of control algorithms for advanced power electronics interfaces. Energy management of microgrids (both islanded and grid-connected), stability, control and operational aspects of power converters connected to the future networks interfacing renewable energy and storage devices are all studied. Development of control schemes for grid services like “grid-forming” with renewable power sources, Power and Sub-synchronous Oscillation Damping Energy scenarios of particular interest. All the algorithms are validated experimentally in the “Smart Energy Integration Lab” environment.

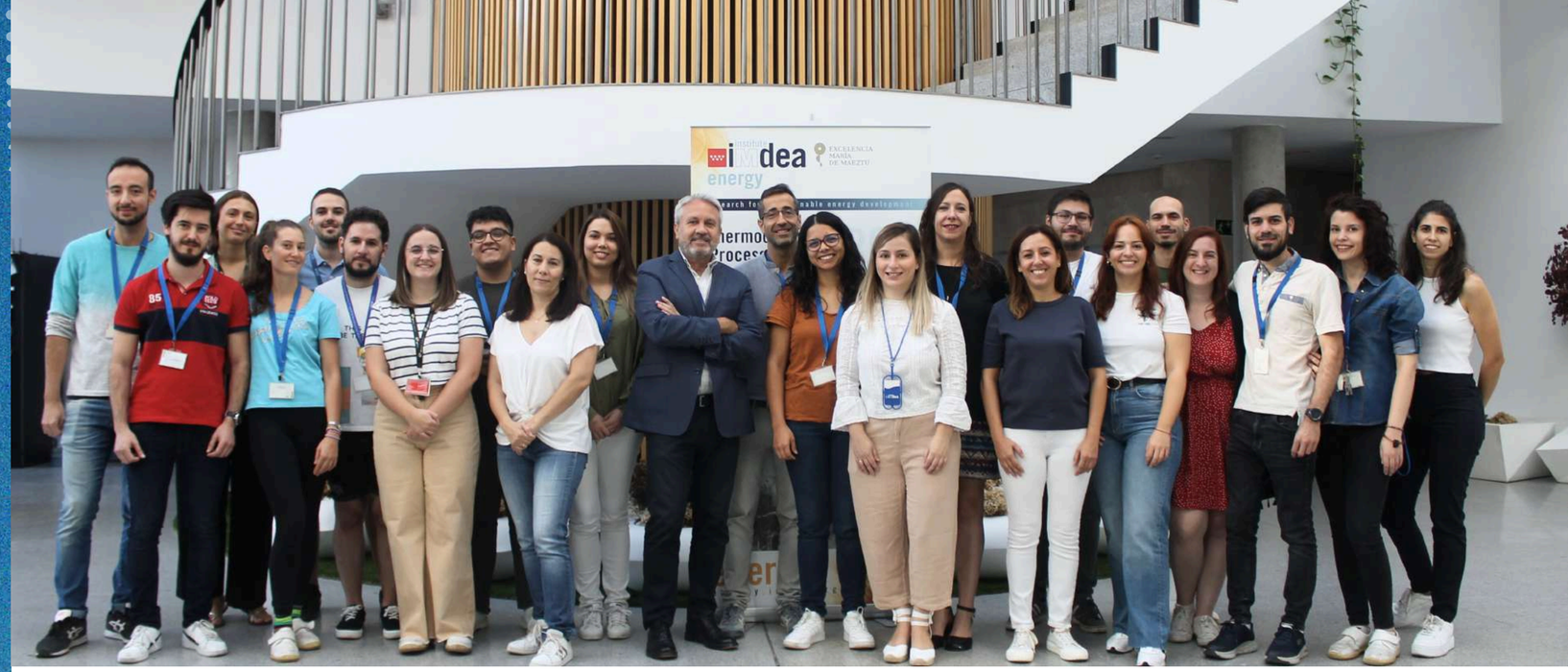
Contact Person/ Scientist in charge

Patricia Pizarro patricia.pizarro@imdea.org

Brief description of the Research Group

The main research activity of Thermochemical Processes Unit (TCPU) is the development of catalysts and processes to produce sustainable fuels and chemicals from various waste-derived sources (biomass residues, plastic waste, biogas and CO_2), thus contributing to the circular economy and energy transition objectives. Concisely, the TCPU has the following capacities:

- Synthesis of heterogeneous catalysts (zeolite-based materials, oxides, etc.) with tailored textural properties and bi or multifunctionality.
- Characterization of catalysts by basic and advanced techniques (gas physisorption, FTIR-pyridine, XRD, TEM, SEM, TPD/TPR, XPS, etc.).
- Activity evaluation of catalysts in different reaction systems (stirred tank, fixed-bed, batch or continuous feeding mode).



Project description

The fellow will participate in the development of processes for the chemo-catalytic valorisation of substrates from different stages of the organic waste transformation cascade. The project may involve the synthesis of catalysts with tailored textural and physico-chemical properties and their comprehensive characterization, as well as the catalytic evaluation in any of the available reaction systems. The goal will be to surpass the results of the state of the art and/or develop new conversion pathways, including one-pot reaction systems (intensification of processes).

Applications

Deadline for submission of documents 5th of July 2024. Documents to be submitted:

- Complete curriculum vitae stating background, skills and a brief description emphasizing the relationship between the applicant CV and the research topic proposed.
- Letter of motivation including research interests.
- Two recommendation letters.

Research Area

- Chemistry (CHE)
- Information Science and Engineering (ENG)