

PhD in Materials Science and Technology

Research Title: Development and optimization of electro-catalysts for CO₂ valorisation

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Context of the research activity	Anthropogenic CO₂ emissions are associated for about two-thirds with the electricity, heat generation, and transport sectors; coal is the main fossil fuel responsible for carbon dioxide emission. Converting CO₂ into valuable products for chemical or energy applications through the use of renewable energy sources, in particular photovoltaic, is a relevant opportunity to introduce renewable energies into the chemical and energy chains, thus realizing efficient resources exploitation, and to tackle concerns about global warming and climate change. CO₂ can be utilized as a ready-to-use raw material to obtain CO (carbon monoxide), CH₄ (methane), CH₃OH (methanol), HCOOH (formic acid) or HCHO (formaldehyde), or other added-value products. Many renewable technologies are commercially available, but there is still the need to develop selective and cost-effective catalysts to promote the CO₂ reduction reaction (CO₂RR) and to move the CO₂ exploitation toward an affordable technology.
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Objectives	The objectives of this PhD are: - Development of novel, selective low-cost, and green catalyst materials for the reduction and conversion of CO₂ to added-value products. Among others, electrocatalyst based on transition metal oxides, and organic catalysts, will be considered. - Optimization of the synthesis procedure and correlation of the physico-chemical properties of the developed catalysts with the catalytic activity to the desired product.
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Skills and competencies for the development of the activity	Students with Physics of Matter, Nanotechnology, Chemistry or Material Sciences backgrounds can be considered suitable for the proposed research activities.
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