SUSTAINABLE MATERIALS, PROCESSES AND SYSTEMS FOR ENERGY TRANSITION

DM 630 HYSYTECH - Scale up of electrochemical processes for CO2 conversion

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Context of the research activity	The research topic of the doctoral scholarship will focus on the development and optimization of electrochemical processes for the conversion of CO2 into C1/C2 products, aiming to overcome the technical and economic challenges for their implementation on an industrial scale. Progetto finanziato dal PNRR a valere sul DM 630/2024 - CUP: E14D24002340004
Objectives	The research will be divided into three main areas: 1. Development of Advanced Materials: (i) synthesis and characterization of new electrocatalysts with high efficiency and stability, specifically designed for CO2 reduction. (ii) Study of electrochemical and structural properties of materials through advanced spectroscopy and electron microscopy techniques (iii) Optimization of electrode-electrolyte interfaces to improve selectivity and yield of desired products. (iv) Study and optimization of scaleup techniques for electrode production. 2. Process Optimization: (i) Design and modeling of electrochemical cells for improved CO2 conversion performance. (ii) Analysis of operating parameters to maximize energy efficiency and productivity. (iii) Optimization of energy and electrolyte management systems to ensure sustainable and continuous process operation. 3. Scale-up and Industrial Applications: (i) Study of degradation mechanisms and mitigation strategies to ensure

	durability and reliability of large-scale systems. (ii) Techno-economic evaluation of scale-up processes, including cost, sustainability and environmental impact. (iii) Collaboration with industrial partners to build pilot plants and validate processes in real operational settings.

Skills and competencies for the development of the activity	The ideal candidate should be a material scientist or engineer, a physical, chemical or energetic engineer, a chemist or a physicist. Expertise in electrochemical measurements, advanced materials synthesis and processes, as well as problem solving ability and practical experience in laboratory would be an additional value. Candidates should have a strong motivation to learn through advanced research.