

CHEMICAL ENGINEERING

AMMIN/DISAT - Unraveling the mechanisms of CO₂ capture and conversion through advanced in-operando characterizations and AI models

Funded By	Dipartimento DISAT Politecnico di TORINO [Piva/CF:00518460019]
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Context of the research activity	Carbon capture and utilization
Objectives	Carbon Capture and Utilization (CCU) is the primary approach in CO ₂ emissions mitigation; an innovative approach is their integration into one single unit, where adsorption and reaction occur sequentially. In the current proposed PhD project, we will study the adsorption of CO ₂ and the subsequent reduction by green hydrogen to form hydrocarbon fuels, that however presents several challenges. The efficient selection of materials, the optimization of composition, synthesis and preparation conditions require deeper understanding of the phenomena involved and the identification of the adsorption and conversion kinetics. This lack of knowledge will be overcome by employing computational and experimental highly innovative tools. The experimental work will focus on in-operando characterization techniques, such as Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFTS) and Raman spectroscopy, lab-scale X-ray absorption spectroscopy (XAS) and high-resolution transmission electron microscopy (HR-TEM, with in-operando cell for catalytic reactions) to identify kinetics and rationally design the catalyst.
Skills and competencies for the development of the activity	Competences in catalysis, advanced characterization techniques and interpretation models.