



PhD Program in Civil, Chemical and Environmental Engineering
Curriculum in Chemical, Materials and Process Engineering

Industrial Projects

November 2024 Call, XL cycle - Starting date: March 1 st 2025

The research projects submitted for the admission to the PhD program must be prepared in accordance to one of the projects listed below. Click on the Title to go to the Project.

[CO2-neutral technologies for the production of carbon-carriers for metallurgy](#)

[Study of mechatronic systems, related materials and methods to provide haptic feedback during open surgery simulation \(with FOS\) – FSE POR REGIONE LIGURIA fellowship](#)



Project: CO₂-neutral technologies for the production of carbon-carriers for metallurgy

Keywords: metallurgical industry, carbon carriers, sustainability, process engineering

Brief Description:

The urgency to mitigate climate change has propelled the development of CO₂-neutral technologies across various sectors, with metallurgy being of significant interest due to its substantial carbon footprint. This research aims to explore and innovate CO₂-neutral technologies for the production of carbon carriers in metallurgy, which are essential for reducing metal oxides in the smelting process. The study will focus on three main objectives: (1) the evaluation of current carbon carriers and their environmental impact, (2) the development of alternative carbon carriers using biomass, industrial waste, and other renewable sources, and (3) the integration of these carriers into existing metallurgical processes, ensuring compatibility and efficiency.

A multidisciplinary approach, combining principles from chemical engineering, material science, and environmental technology, will be employed to address the challenges of transitioning to CO₂-neutral carbon carriers. Life cycle assessments will be conducted to quantify the environmental benefits, while thermodynamic modelling and pilot-scale experiments will be utilized to optimize the production process. The anticipated outcome is a suite of viable, environmentally friendly carbon carriers that can seamlessly replace conventional carbon sources, significantly reducing the carbon emissions of the metallurgical industry. This research has the potential to contribute to the global efforts in achieving a sustainable and carbon-neutral future in metallurgical operations.

Referents:

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Relevant links: <https://www.sms-group.com/>

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Project: Study of mechatronic systems, related materials and methods to provide haptic feedback during open surgery simulation.

Brief Description:

The project deals with the study of miniaturized mechatronic systems capable of providing force feedback suitable for the simulation of open carotid surgery. The objective of this study is to design and develop devices with realistic handles that correctly emulate real surgical instruments and are capable of providing tactile contact and grip feedback (i.e., providing force feedback to simulate the contact of the instrument with tissue and also the opening and closing forces of the instrument). The project also involves the optimization of geometries and materials to guarantee resistance, durability, compatibility and versatility of the mechatronic systems. The project will be carried out in collaboration with FOS and IIT.

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