# CHEMICAL ENGINEERING

## DISAT - Development and Characterization of Low PGM Catalysts for Sustainable Chemical Vectors

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| **Funded By** | Dipartimento DISAT |
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| **Contact** | |
| **Context of the research activity** | This research aims to engineer nanostructured catalysts with high turnover frequencies for chemical vector production, significantly reducing PGM usage. By optimizing catalyst design and composition, the project enhances efficiency and sustainability in catalytic processes, advancing industrial chemistry.<br><br>La borsa di dottorato è finanziata dai progetti:<br>Dal 01/11/2024 al 31/12/2025: Finanziato dall'Unione europea – NextGenerationEU - PNRR M2C2-3.5 – Progetto NOMAH – codice CUP: F27G22000180006<br>Dal 01/01/2026 al 31/10/2027: finanziato dal fondo ELECTROLIFE EU Project – codice CUP: E13C23002930006 |
| **Objectives** | The proposed PhD project falls within the field of Chemical Engineering, specifically focusing on Catalyst Engineering and Nanotechnology. This area explores the synthesis, characterization, and application of nanostructured catalysts to improve chemical processes by increasing efficiency and reducing reliance on scarce materials like platinum group metals (PGMs).<br><br>Objectives of the PhD<br>Catalyst Synthesis and Nano-engineering:<br><br>Design and synthesize nanostructured catalysts with tailored properties to enhance their catalytic activity and selectivity.<br>Employ advanced materials science techniques to develop catalysts with reduced PGM content, aiming to lower costs and dependency on these scarce resources.<br>Characterization and Testing:<br>Utilize a range of spectroscopic and microscopic techniques to characterize the synthesized catalysts at the atomic and molecular levels. Techniques may include X-ray diffraction (XRD), scanning electron microscopy (SEM), and transmission electron microscopy (TEM).<br>Test the catalysts in various chemical vector production and decomposition reactions to evaluate their efficiency and stability under real-world conditions. |

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| **Objectives** | Turnover Frequency Optimization:<br>Investigate the kinetic properties of the catalysts to achieve high turnover frequencies, ensuring rapid and effective chemical transformations.<br>Modify the surface properties and structural composition of the catalysts to maximize their performance and longevity.<br>Scale-Up and Industrial Application:<br>Develop strategies for scaling up the production of effective low-PGM catalysts from the laboratory to industrial levels.<br>Collaborate with industry partners to test the scalability and practical application of the catalysts in industrial settings, focusing on their integration into existing chemical production lines.<br>Publication and Dissemination:<br>Publish findings in high-impact peer-reviewed journals and present results at international conferences to contribute to the broader scientific community and industrial stakeholders.<br>This PhD project aims to not only push the boundaries of chemical engineering and nanotechnology but also make a tangible impact on the sustainability and efficiency of chemical processes in various industries. By advancing the understanding and application of low-PGM catalysts, the research will provide a pathway towards more environmentally friendly and economically viable chemical production techniques. |

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| **Skills and competencies for the development of the activity** | For a PhD focused on low PGM catalysts, required skills include:<br><br>Materials Synthesis: Experience in nanomaterials synthesis and characterization.<br>Analytical Techniques: Proficiency in XRD, SEM, TEM, and spectroscopy.<br>Catalysis and Kinetics: Understanding of catalytic processes and kinetics.<br>Chemical Simulation: Familiarity with process simulation software.<br>Data Analysis: Strong quantitative and analytical skills.<br>Problem Solving: Ability to troubleshoot and optimize experimental designs.<br>Communication: Excellent written and verbal communication skills for disseminating research findings. |