CHEMICAL ENGINEERING

CRT/DISAT - Innovative photocatalytic systems for the ecological transition

Funded By	Dipartimento DISAT FONDAZIONE CRT CASSA DI RISPARMIO DI TORINO [P.iva/CF:06655250014]

Supervisor	PIUMETTI MARCO - marco.piumetti@polito.it

Contact	PIUMETTI MARCO - marco.piumetti@polito.it BONELLI BARBARA - barbara.bonelli@polito.it

Context of the research activity	Design of photocatalytic systems capable of exploiting sunlight for energy and environmental applications: including pollution reduction and renewable energy conversion. This research focuses on the synthesis and optimization of novel photocatalytic materials with high efficiency and stability, specifically targeting the valorization of waste products and the reduction of CO2. The goal is to address critical environmental issues by transforming waste into valuable resources and mitigating greenhouse gas emissions. The study aims to bridge the gap between fundamental research and practical applications, promoting the use of green technologies for a cleaner and more sustainable future. By integrating advanced characterization techniques, this work seeks to enhance the understanding of photocatalytic mechanisms, paving the way for the development of next-generation photocatalysts that can significantly contribute to the ecological transition. Dal 1/11/2024 al 31/07/2025 sul fondo PRIN 2022: “TITOLO PROPOSTA: GREEner Nanomaterials for Upconversion in Photocatalytic applications (CUP E53D23009090006)”, finanziato dall'Unione europea – Next Generation EU nell'ambito del PNRR M4C2, Investimento 1.1 “Fondo per il Programma Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale (PRIN)”- Bando PRIN 2022 del MUR (DECRETO DIRETTORIALE n. 104 del 2 febbraio 2022). Dal 1/08/2025 al 31/08/2025 80% sul fondo PRIN 2022: “TITOLO PROPOSTA: GREEner Nanomaterials for Upconversion in Photocatalytic applications (CUP E53D23009090006)”, finanziato dall'Unione europea – Next Generation EU nell'ambito del PNRR M4C2, Investimento 1.1 “Fondo per il Programma Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale (PRIN)”- Bando PRIN 2022 del MUR (DECRETO DIRETTORIALE n. 104 del 2 febbraio 2022) e 20% sul fondo PRIN 2022 PNRR: Progetto “SCORE2 - Solar-driven COnveRsion of CO2 with HP-HT photorEactor (CUP E53D23015610001)” finanziato dall’Unione Europea – NEXT GENERATION EU nell'ambito del PNRR M4C2, Investimento 1.1 “Fondo per il Programma

	Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale (PRIN)"- Bando PRIN 2022 PNRR del MUR (DECRETO DIRETTORIALE n. 1409 del 14 settembre 2022) Dal 01/09/2025 al 31/10/2025 sul fondo PRIN 2022 PNRR: Progetto "SCORE2 - Solar-driven COnveRsion of CO2 with HP-HT photorEactor (CUP E53D23015610001)" finanziato dall'Unione Europea – NEXT GENERATION EU nell'ambito del PNRR M4C2, Investimento 1.1 "Fondo per il Programma Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale (PRIN)"- Bando PRIN 2022 PNRR del MUR (DECRETO DIRETTORIALE n. 1409 del 14 settembre 2022)

Objectives	The candidate will be involved in the design, synthesis, and characterization of innovative photocatalytic nanomaterials, i.e. TiO2 powered by plasmonic NPs and TiO2 powered by Upconversion nanomaterials to exploit sunlight. She/he will explore the use of these materials in environmental applications, such as the degradation of pollutants, the reduction of CO2, both in water and gas phase. The candidate will also investigate the potential for valorizing waste products, including lignin, through photocatalytic processes. This work will require a multidisciplinary approach, combining principles of chemistry, materials science, and environmental engineering. The candidate will utilize advanced techniques for the nanomaterials characterization to gain insights into the photocatalytic mechanisms and improve the performance of the nanomaterials . The ultimate aim is to develop practical and scalable solutions that contribute to the ecological transition and promote sustainability

Skills and competencies for the development of the activity	The candidate should possess a solid understanding of material chemistry, including the synthesis and properties of various materials, as well as basic knowledge of chemical engineering to apply photocatalytic technologies in pollution control and CO2 reduction. Familiarity with analytical techniques such as UV-Vis/IR/Raman spectroscopies and electron microscopies is important for material characterization. Strong analytical and problem-solving skills are essential for developing and optimizing photocatalytic materials. Effective collaboration in a multidisciplinary team and strong communication skills are crucial for integrating expertise from different fields. Lastly, creative thinking and innovation are key to generating novel ideas and pushing the boundaries of current research, contributing to the development of next-generation photocatalysts for a sustainable future.