MATERIALS SCIENCE AND TECHNOLOGY

DISAT - Catalysts design and characterization addressing batteries and electrocatalysis applications

Funded By	Dipartimento DISAT
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Context of the research activity	This PhD position concerns the design of novel catalytic systems to be applied in cutting-edge energy-related technologies, i.e. Li-S batteries and Li-mediated ammonia production. The activity concerns the development of active materials, supports, their physico-chemical characterization, as well as integration in lab-scale prototype for the subsequent electrochemical testing. The activity is granted by two research projects: - From M1 to M15: SuN2rise project [European Research Council (ERC), under the European Union's Horizon 2020 research and innovation program (grant agreement No. 948769, project title: SuN2rise)] - From M16 to M36: LOTUS project [Bando Fare - 1215/2022, LOTUS - Lithium prOtecTion for robUst and Safe batteries (codice ugov 54_RID22_BEF01) CUP E13C22002510005]
Objectives	The research activity focuses on electrochemistry-based technologies for the energy and ecological transition. In particular, the activity of the PhD student will be based on designing new catalytic materials for energy storage and electrocatalysis. The activity will be based on the definition of synthetic strategies for preparing transition metal-based catalysts (e.g. single-atom formulations, oxides, sulphides, etc.). An extensive physico-chemical characterisation will also be conducted, enabling the fine-tuning of catalytic formulations through the definition of structure-property relationships. In the prepared catalysts, homogeneity at the atomic or molecular level, stoichiometry, structural, and morphological properties will be controlled through the selection of suitable precursors and the use of wet-chemical bottom-up synthesis methods, such as the sol-gel process. The activity will also be extended to carbon-based supports for the above-mentioned catalysts, also including sources like biomasses and wastes. Stability studies of catalytic performances upon time as well as chemometric-aided optimization of electrodic materials assembled with these catalysts will be carried out to assess the structure/composition/activity correlation. From M1 to M15, the activity will be addressed towards systems for nitrogen

	reduction (SuN2rise project), while from M16 to M36 the main application will be that of Li-S batteries (LOTUS project).

Skills and competencies for the development of the activity	Candidates are required to have defended a MSc Thesis in: Chemical Engineering, Material Engineering; Industrial Chemistry; Chemistry; Materials Science; Energy Engineering; Industrial Biotechnologies. Previous activities of the candidates in the field of catalysts design and/or materials chemistry methodologies constitute a preferential skill for the selection process. Capacity to work in a multidisciplinary team and to prioritize the own work for accomplishing deadlines.