MATERIALS SCIENCE AND TECHNOLOGY

IIT - Advanced and operando characterizations of functional materials and systems for the energy transition

Funded By	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA [P.iva/CF:09198791007]
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Context of the research activity	Climate change represents a growing concern. New technologies are currently under development, to reduce anthropogenic carbon dioxide emissions, to produce and exploit green fuels and to improve the efficiency in the employment of renewable feedstocks. To optimize these processes, the reaction mechanisms underneath and the correlation between structural and functional properties of the catalysts have to be deeply investigated.
Objectives	Climate change represents a growing concern in the present days, due to an over-exploitation of fossil fuels that increases continuously atmospheric pollution. New cutting edge technologies are currently under development, with the goal of i) reducing the anthropogenic emissions of carbon dioxide, through its capture, storage and valorization; ii) producing and exploiting green fuels, as for example hydrogen; iii) improving the efficiency in the employment of renewable feedstocks, to ultimately reach a circular economy of resources. These key processes, which normally employ catalysts, need to be optimized, and to this aim, the reaction mechanisms underneath and the correlation between structural and functional properties of the catalysts have to be deeply investigated. Objectives: The objectives of this PhD are: -Assessment of protocols to investigate functional materials using advanced and operando characterization techniques -Improvement of the existing state-of-the-art setup for operando techniques -Characterization of catalysts for key reactions (CO2RR, CORR, HER, OER, ORR) to assess their structure-activity relationship -In situ and operando characterization of catalysts, employing multiple techniques and a correlative approach, to gain insights in their evolution during the catalytic activity.
Skills and competencies for the development of	The ideal candidate should be a material scientist/engineer, chemical or physical engineer, a chemist or a physicist or equivalent degree. Expertise in electrochemistry, advanced processes and nanotechnologies, as well as problem solving ability and practical experience in laboratory would be an

development of the activity	additional value. Candidates should have a strong motivation to learn through advanced research.