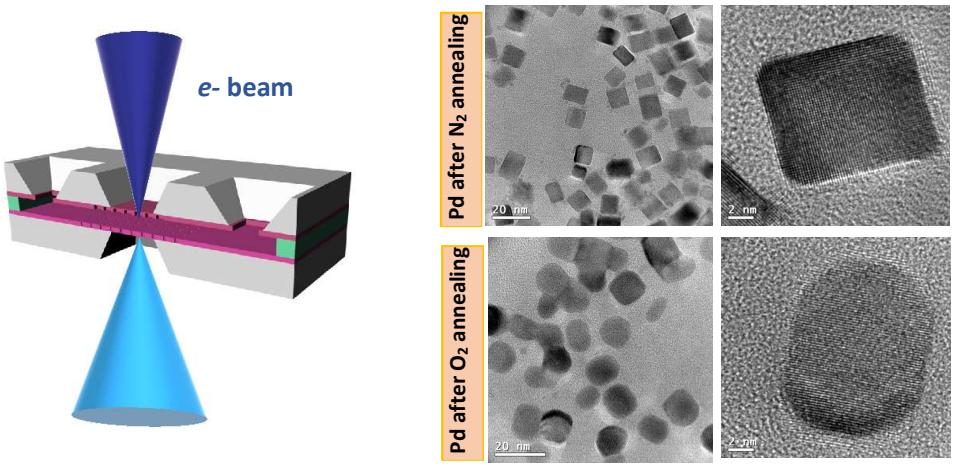
In situ/in operando electron microscopy and correlative techniques on energy materials

Host: LAME, LAboratorio di Microscopia Elettronica, Area Science Park, Trieste



Probing the evolution of electronic, structural, and chemical properties of nanostructured materials under reaction conditions is a crucial issue to determine their structure-functionality relationships and to advance several of the most pressing energy needs, specifically in the areas of catalysis, energy conversion and energy storage. Much of effort has been made lately in designing new solutions and technologies, or modifying the existing ones to characterize energy materials during their life cycle also *in situ* and/or *in operando*, and to follow the change of their properties in the working environment. Often different techniques need to be applied to the same sample to characterize complementary properties such as atomic structure, crystallinity and macroscopic behaviour. Developing a complete understanding of the structure and function of a material over a wide range of length and time scales involves significant challenges that include sample preparation and transfer techniques, spectroscopic, microscopic, macroscopic and functional investigations, correlative and multimodal methods, data analysis and interpretation, as well as data handling, instrument control, and the use of artificial intelligence.

In this project, Transmission Electron Microscopy (TEM) and related spectroscopies will be used to explore the properties of different materials systems (e.g. functional oxides, catalysts, liquid/solid interfaces) in different environments (liquid, ambient pressure, etc...) and under different stimuli (electrical biasing, heating, optical) at operando in situ/in operando conditions. The experimental activity will focus on the development of microreactors for in-situ/in-operando TEM applications and combined experiments by using synchrotron radiation and will be carried out in strong cooperation with the nanofabrication and synchrotron groups located within the Area Science Park. Access to external advanced electron microscopy facilities will be also encouraged and supported.

The ideal PhD candidate shall have a Master Degree in Chemistry, Physics or Materials Science, previous experience with electron microscopy techniques, high drive to work independently in an international research environment with collaboration spirit, and good English skills. Skills in COMSOL simulations, scripting and analysis using programming languages will be an added value.

References

https://en.areasciencepark.it/rdplatform-2023/lame/

Supervisor: Dr. Regina Ciancio regina.ciancio@areasciencepark.it