

# Welcome Seminar

21 Novembre 2024 - h15:00  
Aula A

**Dr. Paolo Dolcet**

Ricercatore a tempo  
determinato di tipo B

Dipartimento di Scienze Chimiche  
Università degli studi di Padova

## From Synthesis to Spectroscopy: Advancing Heterogeneous Catalysis through Operando Investigations

Heterogeneous catalysis is of pivotal importance in addressing several global challenges such as chemical production, energy and environmental sustainability. State-of-the-art catalyst systems are often hierarchically structured across multiple length scales, with their catalytic properties heavily influenced by atomic-scale structure. This inherent complexity, the structural changes under operating conditions and the pronounced heterogeneity typical of industrial catalysts present significant challenges to knowledge-based catalyst development.

In this talk, through examples from my past and present research activity, I will discuss how the controlled preparation of well-defined inorganic nanostructures plays a key role in allowing the identification of the active site at the atomic level, and how *operando* and *in situ* characterization techniques are fundamental for a comprehensive understanding of the structural modifications that interest the active site during operation. In particular, X-ray absorption spectroscopy is an essential and powerful tool for deriving accurate conclusions on the catalytic performances of these functional materials.

Finally, I will conclude by discussing my current research efforts in the group of Prof. Gross, ranging from controlled microwave-assisted preparation methods to the development of reactors for *in situ* studies.