UNIVERSITÀ DI PADOVA
Dipartimento
di Scienze chimiche

DiSC

Monday **June 8th 2026** alle ore **11:00**
presso l'aula G, Dipartimento di Scienze Chimiche

il **Dr. Stefan Merkens**

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terrà il seminario dal titolo:

Developing Liquid Phase Electron Microscopy into a Quantitative Tool for the Study of Functional Nanomaterials

La presenza della S. V. sarà molto gradita

Nome Organizzatore
Lucio Litti

Il Direttore del Dipartimento
Stefano Mammi

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Developing Liquid Phase Electron Microscopy into a Quantitative Tool for the Study of Functional Nanomaterials

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Abstract

Liquid-phase electron microscopy (LP-EM) is an emerging experimental technique which permits the nanoscale imaging of functional materials and their processes in liquid media. In recent years, microfluidic reactors have been developed to expose samples to external stimuli directly inside the microscope, enabling the investigation of relevant physico-, bio- and electrochemical phenomena under operando conditions.

Despite these advances, the ionizing radiation required for imaging remains a major limitation. Irradiation of aqueous solutions with a high-energy electron beam generates substantial quantities of highly reactive species, which initiate cascades of complex chemical reactions that can ultimately alter or disrupt the processes under investigation. At the same time, stringent constraints imposed by the microscope have limited the design of microfluidic reactors capable of reproducing laboratory-like conditions, thereby restricting the acquisition of reliable and quantitative information.

This talk summarizes our contributions to establishing LP-EM as a quantitative characterization technique. It highlights approaches to understand and control radiation-induced reaction kinetics in relevant LP-EM scenarios through computational modelling and experimentation.[1,2] In addition, it discusses the prototyping of next generation microfluidic reactors designed to better replicate operando conditions and to enable advanced correlative capabilities.[3,4] Ultimately, the acquired knowledge is leveraged to improve LP-EM methodology,[5] paving the way for a more reliable control and interpretation of experiments.

Bibliography

1. De Salvo, G. *et al*., A workflow for modeling radiolysis in chemically, physically, and geometrically complex scenarios. iScience 28, (**2025**).
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4. Merkens, S. *et al*., Toward sub-second solution exchange dynamics in flow reactors for liquid-phase transmission electron microscopy. Nat Commun 15, 2522 (**2024**).
5. Bejtka, *et al*., Electrochemical Liquid Phase TEM in Aqueous Electrolytes for Energy Applications: the Role of Liquid Flow Configuration, *Small Methods*, 9, 3 (**2025**).