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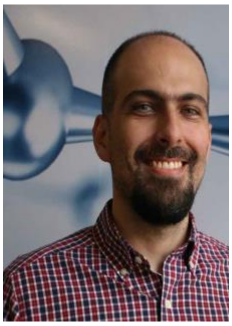


**Dr. Murilo Santhiago[1,2]**

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**CV:** Dr. Murilo Santhiago is a researcher at the Brazilian Nanotechnology National Laboratory (LNNano), part of the Brazilian Center for Research in Energy and Materials in Campinas, Brazil. He earned his bachelor's in chemistry from Federal University of Santa Catarina in 2007 and completed his master's (2010) and PhD (2014) at University of Campinas (UNICAMP), including an internship at Colorado State University (CSU) in Fort Collins-CO focusing on flexible electrochemical devices. He later conducted postdoctoral research on microfluidics and 2D materials, and was a visiting researcher at INL in Portugal (2019), developing electrodes for energy applications. In 2020, he received support from the Serrapilheira Institute to study the impact of chemical defects on 2D materials for hydrogen evolution reaction (HER). Since 2020 he has been named as an outstanding young researcher by many journals: Nanoscale (Nanoscale 2022 Emerging Investigators), Analytical and Bioanalytical Chemistry (Young Investigators in (Bio-)Analytical Chemistry 2023), and ACS Measurement Science Au (2023 Rising Stars). His main research interests are flexible electrochemical nanodevices, cellulose-based devices, micro-nanofabrication, and 2D materials applied to energy, environment, and health.

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**26 september 2025**
**Dipartimento di Farmacia (DIFAR)**
**Viale Benedetto XV, 3**
**Aula A. Ranise, 14:00-15:00**

## *Tuning the electrocatalytic activity on the basal plane of ultra-large $MoS_2$ layers for hydrogen evolution reaction*


**Abstract**

The basal plane of $MoS_2$ is known to be inactive for hydrogen evolution reaction (HER) due to a lack of active sites. The introduction of surface defects plays an essential role in tuning the electrocatalytic activity on the basal plane of $MoS_2$ monolayers for hydrogen evolution reaction (HER). The field is progressing towards achieving cost-effective, sustainable, and efficient electrocatalysts [1]. The catalytic sites of $MoS_2$ monolayers towards hydrogen evolution are mainly vacancies and edge-like defects. Controlling the size, position, and defective areas on the basal plane of $MoS_2$ through defect-engineering methods is challenging [2-4]. In this seminar, I´ll show how ultra-large supported and free-standing $MoS_2$ samples are prepared using a simple and fast electrochemical thinning method. Patterning techniques that can precisely introduce defects on the basal plane will be discussed next. Specifically, focused ion beam (FIB) and nanolithography can be employed to generate arrays of edge-like defects on electrochemically thinned $MoS_2$, allowing for precise tuning of its electrocatalytic performance for HER. To obtain atomic-scale insights into the transformations resulting from defect engineering, high-resolution transmission electron microscopy was utilized. Thus, the observed transformations in the free-standing samples can be directly associated with the enhanced electrocatalytic activity of the basal plane following defect-engineering procedures.



[1] M. Santhiago *et al.*, *Nanoscale*, 14, (2022) 6811.
[2] M. Santhiago *et al. J. Mater. Chem. A*, 11, (2023) 19890.
[3] M. Santhiago *et al. J. Mater. Chem. A*, 12, (2024) 17338.
[4] M. Santhiago *et al. J. Mater. Chem. A,* 13 (2025) 951.



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