**Czech Chemical Society Lecture**

**Thursday, May 14, 2026, 14:00**

**University Campus Bohunice, Kamenice 5, Building B11 / room 132**

# Electrocatalysis and Electrosynthesis: Insights and Developments through Reaction Monitoring


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Understanding reaction mechanisms is the key to developing new chemical reactions. Electrospray ionization mass spectrometry has a unique dynamic range that allows for studying reaction mixture compositions, including low-abundant reactive intermediates, side products, and degraded forms of catalysts.[1] In the lecture, I will focus on mapping electrochemical transformations and detecting and characterizing reaction intermediates (Figure 1).[2-6] I will present our approach to using advanced mass spectrometry methods, such as ion spectroscopy, to characterize reactive species by vibrational and electronic spectroscopy.[7] I will also show how understanding the processes at the electrode interface enable development of new reactions.[8]

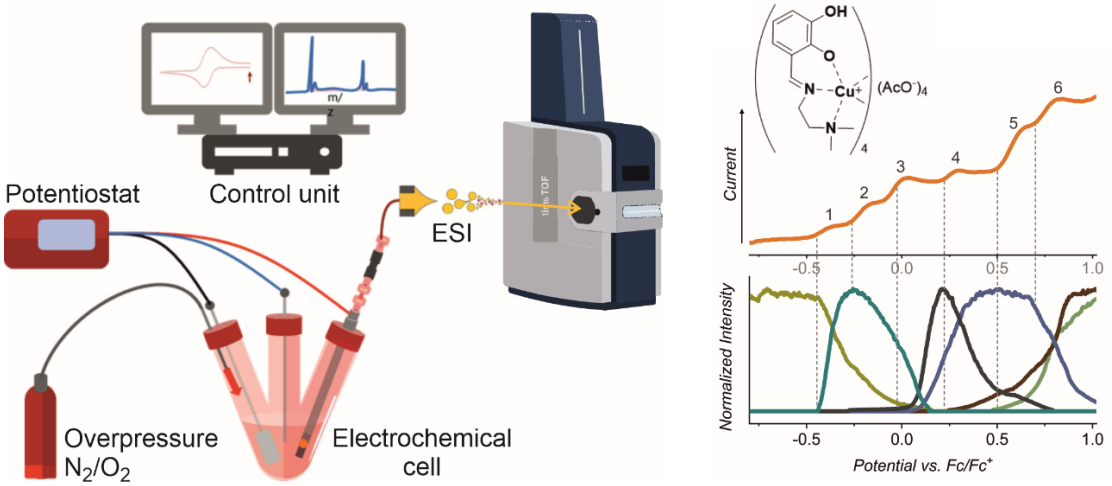


**Figure 1**. VESI-MS (Voltammetry – electrospray ionization mass spectrometry) setup and an example of a voltammogram coupled with ion abundances from mass spectra in dependence of the potential.

References:


(1) J. Mehara, J. Roithova, Identifying reactive intermediates by mass spectrometry, *Chem. Sci.* **2020**, *11*, 11960.
(2) A. Koovakattil Surendran et al., Intricacies of Mass Transport during Electrocatalysis: A Journey through Iron Porphyrin-Catalyzed Oxygen Reduction, *J. Am. Chem. Soc.* **2024**, *146*, 15619–15626.
(3) A. Koovakattil Surendran, J. Roithová, Decoding Voltammograms at the Molecular Frontier: Integration of Voltammetry and Mass Spectrometry , *Chem. Methods* **2024**, *4*, e202400003.
(4) A. Koovakattil Surendran et al., Host-guest tuning of the CO2 reduction activity of an iron porphyrin cage, *Nat. Sci.* **2023**, *3*, e20220019.
(5) A. Bairagi et al., Electrocatalytic CO2 Reduction: Monitoring of Catalytically Active, Downgraded, and Upgraded Cobalt Complexes, *J. Am. Chem. Soc.* **2024**, *146*, 5480 – 5492.
(6) A. Koovakattil Surendran et al., Intricacies of Mass Transport during Electrocatalysis: A Journey through Iron Porphyrin-Catalyzed Oxygen Reduction, *J. Am. Chem. Soc.* **2024**, *146*, 15619–15626.
(7) J. Roithová et al., Helium Tagging Infrared Photodissociation Spectroscopy of Reactive Ions, *Acc. Chem. Res.* **2016**, *49*, 223.
(8) A. . Koovakattil Surendran, J. Roithová, Paired Pulsed Decarboxylative Hydroxylation Designed by Online Electrochemistry–Mass Spectrometry, *J. Am. Chem. Soc.* **2025**, *147*, 36975–36979.