

# Electrocatalysis: Powering the Transition to a Green Future

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In the EU's transition toward a green future, electrocatalysis offers an elegant solution for converting our chemical industry, transportation, and energy sectors to renewable sources like solar and wind. Electrochemistry, as the interplay between chemical and electrical processes, represents modern technologies, from smartphone batteries to industrial electrolyzers for aluminum and chlorine production. With renewable energy becoming increasingly affordable, integrating electrochemical devices with clean power sources becomes essential, positioning electrochemistry as a cornerstone in our quest for a fossil fuel-free society.

Electrochemical pathways for producing essential chemicals like hydrogen, ammonia, and ethylene offer promising solutions for decarbonizing key sectors such as aviation, shipping, polymer manufacturing, and agriculture. Electrocatalysis lies at the core of these processes, governing their efficiency. Studying, understanding and ultimately utilizing atomic-scale insights into their structural-property relationships are crucial for enhancing performance and designing superior materials.

In my talk, I will present recent studies from our laboratory, spanning Pt-based fuel cell electrocatalyst design and characterizations [1], the development of advanced characterization methods [2], non-noble metal catalysis for electrolysis [3] and studies on CO<sub>2</sub> reduction electrocatalysis behavior [4].

1. Tina Đukić, Léonard Jean Moriau, Iva Klofutar, Martin Šala, Luka Pavko, Francisco Javier González López, Francisco Ruiz-Zepeda, Andraž Pavlišič, Miha Hotko, Matija Gatalo, Nejc Hodnik, *ACS Catalysis*, **2024**, vol 14, 4303–4317.
2. Leonard Moriau, Tina Đukić, Vojtech Domin, Roman Kodym, Martin Prokop, Karel Bouzek, Matija Gatalo, Martin Šala, Nejc Hodnik, *Electrochimica Acta*, **2024**, vol 487, 144200.
3. Luka Suhadolnik, Marjan Bele, Milutin Smiljanić, Goran Dražić, Lidija D. Rafailović, Daniela Neumüller, Martin Šala, Anja Logar, Nejc Hodnik, Miran Gaberšček, Janez Kovač, Urška Trstenjak, Tiziano Montini, Michele Melchionna, Paolo Fornasiero, *Materials Today Chemistry*, **2024**, vol 35, 101835.
4. Stefan Popović, Mohammed Azeezulla Nazrulla, Primož Šket, Khaja Mohaideen Kamal, Blaž Likozar, Luka Suhadolnik, Luka Pavko, Angelja Kjara Surca, Marjan Bele, Nejc Hodnik, *Electrochimica Acta*, **2022**, vol 436, 141458.