

EPFL Valais/Wallis SEMINAR

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Synthesis of trimetallic NiCoFe-MOF nanocomposite grown on nickel foam as highly efficient, durable bifunctional electrocatalysts toward urea electrolysis.

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H₂ production from water can become more viable by replacing water with more easily oxidized molecules. Assorted molecules, such as hydrazine, ethanol, methanol, 5-hydroxymethylfurfural, and urea have been proposed to improve the energy conversion competence of electrolyzers because of their more favorable oxidation thermodynamics.¹⁻³ The replacement of the energetically and kinetically undesirable OER with the urea oxidation reaction (UOR) can considerably decrease the cell voltage. Moreover, the electrolysis of urea offers not only energy saving H₂ production but achieves urea-rich wastewater remediation at the same time. Recently some researchers developed UOR catalysts by using two-dimensional MnO₂ crystals, Ni-Mo-based nanostructures, metallic Ni(OH)₂ nanosheets, nickel, and its composites, although improvements are still necessary for the stability and activity of UOR catalysts.⁴⁻⁵ Hollow nanostructures research is focused on energy applications that provide more unprotected active sites of structure, and also shorten the charge transport pathways and the mass compared to the corresponding architectures with solid cores.⁶ The Li group reported trimetallic NiCo/Fe₃O₄ heteroparticles within MOF-74 for efficient OER.⁷ Furthermore, general strategies for the construction of nanostructures with the same morphology in various compositions are desired, which could provide a reliable platform to exploit the structure-composition relationship.⁸

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Born in 1992 in Damietta, Egypt, Ahmed El-Harairy graduated with a B.S. (HONS) in Environmental Sc. from the Mansoura University in 2013. He went Sep. 2016 to Huazhong University of Science and Technology in China for a Master thesis mentored by Prof. Dr. Yanlong Gu and completed with the MSc. Degree (HONS) in Jul. 2019. Then he went to the University of Science and Technology of China in Hefei, China, 2019-2020 for an internship in the nano energy lab and then back to Damietta University in Egypt as a teaching assistant of material chemistry.