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Engineering Sustainable Electrocatalysts for Renewable Energy Storage in E-Fuels

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online

link will be emailed to registered participants

Registration Form

Protecting our planet while sustaining industrial and economic growth is an ambitious and essential aim that needs to be achieved at a global scale to be successful. Governments have expressed worldwide support to commit to net-zero emission targets to mitigate climate change. This requires development of new technologies to rapidly decrease our reliance on fossil-fuel resources. Chemical storage of renewable energy harvested from solar farms and wind by electrochemical hydrogen production is an attractive approach to enable the export of renewable energy to countries with less access to renewable energy sources and/or very high population density. Electrochemical hydrogen production is also beneficial as an intermediary large scale energy storage approach for stabilization of the electrical grid and on-demand off-the-grid power generation. While a variety of carbon-emission-free electrochemical hydrogen production technologies have reached commercial maturity, they still rely on rare and expensive electrocatalyst that undermines their inherent scalability below that required for adoption of hydrogen as global energy carrier. Furthermore, the high cost and poor lifetime of these rare catalysts increase the cost electrochemical production of hydrogen hindering its economic sustainability.
In this paper, we will discuss emerging approaches for the use of low-cost earth abundant materials as efficient electrocatalysts for green hydrogen and e-fuels production. The multi-scale engineering of nano-micro materials and their integration in effective macro-scale morphologies will be presented as successful strategy for the use of a variety of earth-abundant rock forming elements as electrodes and membranes of electrolysers. The need to overcome the limitations imposed by single constituent such as the poor electrical conductivity of iron oxide and/or surface activity of manganese oxide will be demonstrated by the fabrication of highly performing nano-micro composite electrocatalysts made of carefully controlled hierarchical structures. We will showcase the use of the latest generation of flame-aerosol synthesis reactors for the direct roll-to-roll fabrication of electrodes for alkaline and acidic electrolysers, demonstrating a scalable path for the low-cost production of green hydrogen from renewable energy sources. The advantages and challenges of the flame synthesis route will be critically discussed providing directions for its optimization as a scalable technology for electrocatalyst production.

More info: www.cmic.polimi.it