Advanced materials for the energy transition: Renewable fuels and chemicals

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The substitution of fossil fuels by renewable energy sources is expected to become a major pillar in the decarbonization of the energy and chemical industries. Thus, there is a general interest in the development of alternative electrochemical methods at the industrial level to facilitate the introduction of renewable electricity as key power source. Arguably, the major challenge remains to improve the efficiency of the electro-synthetic processes, at low temperature and pressure, by design and implementation of efficient catalysts while limiting costs and avoiding the use of critical raw materials. In this talk, we will discuss some of the most representative achievements in the state-or-the-art in Energy-related electrocatalysis towards efficient, robust and scalable methods, focusing in their advantages, and addressing their current limitations, if any. The role of the electrocatalysts activating the desired substrates and avoiding high-energy reaction intermediates will be discussed. The integration into artificial photosynthesis schemes will be highlighted. Many successful catalysts are still based on noble metals or critical raw materials, far away from practical applications. When discussing renewable fuels and chemicals as a plausible contribution to decarbonization, energy security and environmental mitigation plans, sustainability and scaling are additional constrains that must be taken into account. There are many hurdles between a promising lab-scale discovery and a viable technology, many of them involving economic and societal considerations.