

Low loading CRM and CRM - free electrocatalysts as new cost – effective strategy in PEMWE

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To achieve cost-effective green hydrogen production by proton exchange membrane (PEM) water electrolysis (WE), it is necessary to minimize the use of high-cost metal electrocatalysts. In a PEM electrolysis system, one of the most studied nowadays for water splitting, the membrane electrode assembly (MEA) typically consists of an iridium and/or ruthenium catalytic layer at the anode side for the oxygen evolution reaction (OER), a platinum-based catalytic coating at the cathode side for the hydrogen evolution reaction (HER) and a proton-exchange polymer membrane, characterized by perfluorosulfonic acid (Nafion® or Aquivion®). The high costs of the noble materials used as catalysts ("critical raw materials", CRM) and the supply risks due to scarcity and environmental problems are the disadvantages to overcome to reduce the costs of PEM technology. Therefore, in order to minimize the use of expensive materials, this work aims to evaluate non-critical raw materials as possible candidate for catalyzing the OER and the HER, such as silver on advanced conductive electro-ceramic supports based on Ti oxide nanoparticles (Ti- suboxides, Ti_nO_{2n-1} , with Magneli phase) for the anode side and MoS_2 ($1\text{ mgMoS}_2\text{ cm}^{-2}$) on carbon black for the cathode side. Another strategy to reduce the amount of CRM involves reducing noble metal catalysts to a level comparable to that of automotive fuel cells.