

Corrosion and Protection of Key Materials for Hydrogen Production via Water Electrolysis Using Renewable Energy

Hong Luo, Xuefei Wang, Hongxu Cheng

National Materials Corrosion and Protection Data Center, Institute for Advanced Materials and Technology, University of Science and Technology Beijing, Beijing 100083, China

Presenter's e-mail address: luohong@ustb.edu.cn

Abstract Proton exchange membrane (PEM) electrolyzers are the core technology for hydrogen production via water electrolysis using renewable energy. One of the critical components, the titanium bipolar plate, faces harsh operating conditions during electrolysis, including strong acidity, high voltage, and oxidative atmospheres. Such environments lead to surface corrosion of the titanium bipolar plate, which affects its electrical conductivity, mechanical strength, and durability. To enhance the lifespan and performance of titanium bipolar plates, various surface protective coating technologies have been developed, including conductive coatings, anti-corrosion coatings, and composite functional coatings. These coating technologies effectively reduce corrosion and improve the electrical conductivity and corrosion resistance of the bipolar plate by forming a dense protective layer on the material surface. This paper reviews the operating environment of titanium bipolar plates in PEM electrolyzers and the corrosion behavior of their key materials, analyzes the protective mechanisms of various surface coating technologies, and discusses their potential applications in improving the efficiency of hydrogen production via water electrolysis.

Keywords: *Water Electrolysis, Renewable Energy, Corrosion, Passive film*

Reference

- [1] X Wang, X Jin, W Hao, H Cheng, H Luo, Effect of cold deformation on the corrosion behavior of ZrTiNb alloys in an anodic environment of proton exchange membrane water electrolysis, *Corrosion Science*, 2024,112207.
- [2] X Wang, H Luo, H Cheng, L Yue, Z Deng, J Yao, X Li, Investigation on the performance of Pt surface modified Ti bipolar plates in proton exchange membrane water electrolyzer, *Applied Energy*, 2024, 357, 122517.
- [3] H Cheng, H Luo, X Wang, Z Pan, Q Zhao, C Dong, X Li, Improving the performance of titanium bipolar plate in proton exchange membrane water electrolysis environment by nitrogen-chromium composite cathode plasma electrolytic deposition, *International Journal of Hydrogen Energy*, 2023, 48 (98), 38557-38568.