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Research on the key technology of alkaline water electrolysis coupled with renewable energy to produce green hydrogen

Abstract:

The generation and use of hydrogen energy from renewable sources has become one of the most important directions for achieving carbon peak and carbon neutrality in the future. At present, alkaline electrochemical water splitting is regarded as a more environmentally friendly, efficient, and economical strategy to generate clean and high-purity hydrogen, especially using electricity from renewable sources such as wind and solar. The electrode and diaphragm account for the highest proportion of the cost of the alkaline electrolyzer. A significant reduction of noble metal catalyst loading and simplification of electrode fabrication is urgently needed to lower the cost of anion exchange membrane electrolyzer for large-scale hydrogen production. In this study, the design and rapid preparation of anion exchange membrane (AEM) electrolyzer and catalytic electrode are studied. We developed a novel and simple strategy to construct Pt-decorated $\text{TiO}_2/\beta\text{-Ni(OH)}_2$ nanosheet arrays and $\text{Fe}_2\text{O}_3/\text{Ni(OH)}_2/\text{NF}$ that steadily deliver large current densities for HER and OER, respectively, in alkaline electrolytes. The $\text{Pt}/\text{TiO}_2/\text{Ni(OH)}_2/\text{NF}$ and $\text{Fe}_2\text{O}_3/\text{Ni(OH)}_2/\text{NF}$ can afford industrial current densities of 1000 mA cm^{-2} at ultralow overpotentials of 145 mV for HER and 319 mV for OER, respectively. Besides, the other effect factors of the cell voltage such as photovoltaic (PV) power production, electrolyzer channel, and diaphragm are also discussed.

Biography

Aiqun Kong has completed his PhD at the age of 32 years from Tianjin University. His main research direction is the development of catalytic electrodes for green hydrogen production from renewable energy sources and the process intensification of electrolyzer systems. He has published more than 23 papers in reputed journals.