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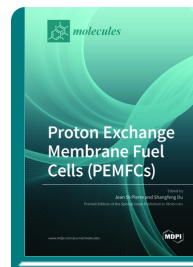
Special Issue Reprint

Proton Exchange Membrane Fuel Cells (PEMFCs)

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The proton exchange membrane fuel cell is an electrochemical energy conversion device, which transforms a fuel such as hydrogen and an oxidant such as oxygen in ambient air into electricity with heat and water byproducts. The device is more efficient than an internal combustion engine because reactants are directly converted into energy through a one-step electrochemical reaction. Fuel cells combined with water electrolyzers, which electrochemically split water into hydrogen and oxygen using renewable energy sources such as solar, mitigate global warming concerns with reduced carbon dioxide emissions. This collection of papers covers recent advancements in fuel cell technology aimed at reducing cost, improving performance, and extending durability, which are perceived as crucial for a successful commercialization. Almost all key materials, as well as their integration into a cell, are discussed: the bus plates that collect the electrical current, the gas diffusion medium that distributes the reactants over catalysts promoting faster reactions, and the membrane separating oxygen and hydrogen gases and closing the electrical circuit by transporting protons. Fuel cell operation below the freezing point of water and with impure reactant streams, which impacts durability, is also discussed.



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