Prospects of battery proton exchange membrane field

Are proton exchange membrane fuel cells a reality?
In recent years,proton exchange membrane (PEM) fuel cells have regained worldwide attention from academia,industries,investors,and governments. The prospect of PEM fuel cells has turned into reality,with fuel cell vehicles successfully launched in the market.

What is a proton exchange membrane?
The proton exchange membrane (PEM) is a critical element; it is made of semipermeable polymer and serves as a barrier between the cathode and anode during fuel cell construction. Additionally, membranes function as an insulator between the cathode and anode, facilitating proton exchange and inhibiting electron exchange between the electrodes.

Can proton-exchange membrane fuel cell vehicles achieve high power density?
These concepts are expected to be implemented in next-generation PEMFCs to achieve high power density. This Perspective reviews the recent technical developments in the components of the fuel cell stack in proton-exchange membrane fuel cell vehicles and outlines the road towards large-scale commercialization of such vehicles.

Why are proton exchange membranes prone to dehydration?
Moreover,proton exchange membranes are prone to dehydration in high temperature and dry environments,resulting in the reduction of the cell performance. Because of the relatively harsh operating conditions of portable applications,it is not possible to maintain the best performance of the fuel cell.

Does bipolar plate geometry affect the performance of proton exchange membrane fuel cells?
A comprehensive study of the effect of bipolar plate (BP) geometry design on the performance of proton exchange membrane (PEM) fuel cells. Renew. Sustain. Energy Rev. 111, 236-260 (2019). Dubau, L. et al. A review of PEM fuel cell durability: materials degradation, local heterogeneities of aging and possible mitigation strategies.

What are proton exchange membrane fuel cells (PEMFCs)?
The research on proton exchange membrane fuel cells (PEMFCs) has significantly escalated due to their exceptional efficiency and eco-friendliness, but there is still much ground to cover. These cells find applications in various sectors such as transportation, portable power, stationary power, aerospace, and underwater.

Flow field design and optimization are critical for the proton exchange membrane (PEM) fuel cells to meet the requirement of ultra-high power density commercial applications. However, the multi-physics transport mechanism inside such large-scale PEM fuel cells has not been fully understood. In this study, we have developed a three-dimensional (3D) PEM fuel ...

Proton Exchange Membrane Fuel Cell (PEMFC) is currently the best performance among all fuel cells, which has high specific energy, low operating temperature, fast starting, no leakage, and ...

Proton exchange membrane fuel cells (PEMFCs) are promising power sources owing to their high-power/energy densities and low pollution emissions. With the increasing demand for electricity for various low-power devices, small-scale storage of electricity encountered bottle-neck, which provides new opportunities for PEMFC. Owing to the ...

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The study of proton exchange membrane fuel cells (PEMFCs) has received intense attention due to their wide and diverse applications in chemical sensors, electrochemical devices, batteries, supercapacitors, and power generation, which has led to the design of membrane-electrode assemblies (MEAs) that operate in different fuel cell types [1, 2, 3].

Hydrogen energy from electrocatalysis driven by sustainable energy has emerged as a solution against the background of carbon neutrality. Proton exchange membrane (PEM)-based electrocatalytic systems represent a promising technology for hydrogen production, which is equipped to combine efficiently with intermittent electricity from renewable energy ...

The study of proton exchange membrane fuel cells (PEMFCs) has received great attention from the scientific community. The main objectives of research in this area are to reduce greenhouse gas emissions, especially in the automotive industry, and develop new techniques and materials to increase the efficiency of PEMFCs at a reasonable cost.

To analyse the performance of numerous polymeric proton exchange membranes compared to commercially available Nafion membranes. To discusses the problems connected with several types of PEMs, as well as the current techniques used to improve their characteristics and performance.

Also, Fan et al. [30] reviewed the essential elements of proton exchange membrane fuel cells (PEMFC), water and heat management, and associated characterization methods. The centerpiece of their research was a unique analysis of PEMFCs in automotive applications, which paved the way for creating the infrastructure needed for hydrogen ...

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This study develops composite membranes with through-plane-aligned proton channels, showing that thus oriented channels improve proton conductivity and durability, and ...

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Proton exchange membrane fuel cells (PEMFCs) that possess a high energy conversion efficiency meet the demand of green and sustainable development, in addition to the advantages of the zero emission and low operation temperature [1], [2].Currently, the large power stack has been successfully applied for the commercial fuel cell vehicles (FCVs) [3], [4].

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Proton exchange membrane fuel cells (PEMFCs) generate power from clean resources, such as hydrogen and air/O 2. It has a high energy conversion efficiency from the chemical energy of a fuel and an oxidant to electric power, reaching about 60 % [1], [2].

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