



## **Promise and Challenges of Direct Alcohol Fuel Cells**

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Ethanol is a sustainable, carbon-neutral transportation fuel source. It is an ideal fuel for direct oxidation fuel cells for portable and transportation applications, as it offers multiple advantages over hydrogen and methanol, including higher energy density and ease of transportation, storage and handling. Conventional acid direct ethanol fuel cells (DEFC) that use platinum-based catalysts have demonstrated extremely low performance (the state-of-the-art peak power density is  $30 \text{ mW cm}^{-2}$  at  $60^\circ\text{C}$ ). Radically different from conventional systems that use acid proton-exchange membranes (PEM) and precious metal catalysts, our group has recently demonstrated that the use of alkaline anion-exchange membranes (AEM) would dramatically boost cell performance, even with non-platinum metals as catalysts (the state-of-the-art peak power density is  $185 \text{ mW cm}^{-2}$  at  $60^\circ\text{C}$ ). This talk will provide an overview of recent developments in the AEM DEFC technology and discuss about challenging issues to be tackled in the future.

**Keywords:** ethanol; alkaline anion-exchange membranes; direct alcohol fuel cells



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## 直接醇類燃料電池的前景與挑戰

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乙醇是一種可持續的，碳中和運輸燃料源。從便攜和運輸方便的要求來看，這是直接氧化燃料電池的一個理想燃料，相對於氫和甲醇它提供了多個優點，包括更高的能量密度和便於運輸，儲存和處理。常規酸直接乙醇燃料電池（DEFC）用鉑基催化劑表現出極低的性能（目前最先進的峰值功率密度為 60°C 時可達到每平方厘米 30 毫瓦）。從根本上不同於使用酸質子交換膜（PEM）和貴金屬催化劑的傳統系統，我們的研究最近證明即使用非鉑族金屬作催化劑，使用鹼性陰離子交換膜（AEM）將大大提高電池的性能，（目前最先進的峰值功率密度為 60°C 時可達到每平方厘米 185 毫瓦）。本講座將概述 AEM DEFC 技術的最新發展，並討論未來需解決的挑戰性問題。

**關鍵詞：** 乙醇； 鹼性陰離子交換膜； 直接醇類燃料電池