

## **High-Temperature Polymer Electrolyte Membrane Fuel Cells for Heavy-duty Vehicle Applications: Recent Development and Catalyst Challenges**

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### Abstract Content:

High-temperature polymer electrolyte membrane fuel cells (HT-PEMFCs), which can operate above 100 °C under anhydrous conditions, have attracted increasing interest in recent years. Several merits over low-temperature PEMFCs, including reduced complexity in fuel cell systems, easier heat management and higher CO tolerance, make it an ideal solution for heavy-duty vehicle applications. Recently developed ion-pair HT-PEMFCs has a significantly lower concentration of phosphoric acids in the membrane electrode assembly (MEA), which leads to both elevated performance and durability. More importantly, these ion-pair HT-PEMFCs exhibit stable performance at 80 – 160 °C operating temperature range, making it potentially feasible for vehicle applications. Here in this talk, we first explain the difference in MEA configuration and fuel cell performance between conventional polybenzimidazole-based HT PEMFCs and ion-pair HT PEMFCs, as well as the performance gap with 2<sup>nd</sup> Generation MIRAI fuel cells. Next, we discuss the catalyst challenges, which mainly come from the phosphate anion poisoning. The correlation and difference of oxygen reduction reaction (ORR) on Pt and a series of platinum alloy (Pt-M) catalysts in both dilute and concentrated phosphoric acid will be discussed. Lastly, we will share our perspectives of key questions that need to be addressed to design high-performance catalysts for HT-PEMFCs.