

Current Research Status of PEM Fuel Cell for Sustainable Road Vehicles

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The literature on the use of proton exchange membrane (PEM) fuel cells in automotive applications clearly shows that the technology is ready for commercialization. The popularity of PEM fuel cell technology in automotive applications is due to its simplicity, reliability and efficient energy conversion in a compact structure. Further, PEM fuel cell are least polluting when used in automotive application as compared to conventional internal combustion engine. In fact, NO_x emissions are eliminated due to conversion of chemical energy of hydrogen into electrical energy, which then drive the electric motor.

Though the PEM fuel cells have technological readiness and few automotive companies have made some prototype of Fuel cell based cars, the research on various facets to improve the performance of PEM fuel cell is still undergoing. The basic metrics for investigating the performance characteristics of the fuel cell based car are the power, voltage, current, and speed it produces under various load circumstances. Researchers are also focusing on the primary sources of degradation for fuel cell systems i.e. start-stop cycles along with other dynamic situations such as idling, load cycling, or high power in analysing the performance of PEM fuel cell incorporated in automotive applications. The current research on automotive PEM fuel cell system also involve steady-state thermodynamics model to explore the impacts of vehicle speed and operating pressure on the size of system components, heat and water creation, fuel consumption, fuel cell, and system efficiency. A huge number of studies are still being conducted to improve the performance of PEM fuel cells and their application in the automotive industry, and they are worth discussing.

The remaining problems and opportunities for improvement for PEM fuel cells are high current density performance, durability, and cost. These issues are likely to be rectified during the next decade, when hydrogen infrastructure becomes more widely available.

Based on the foregoing, the current topic will cover the recent status of PEM fuel cell technology development and applications in transportation, as well as the need for fundamental research in this field. Besides, it will also outline major challenges in fuel cell technology development and the need for fundamental research in the near future and prior to fuel cell commercialization.