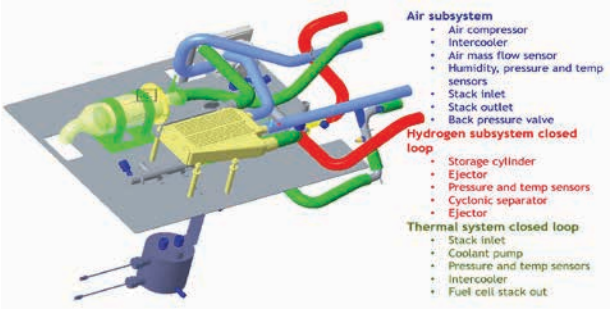
Lightweight Fuel Cell Stacks for Light-Duty Vehicles



Problem Statement: Conventional IC engine based powertrain causes carbon dioxide emissions and air pollution. Vehicle drive trains need to be replaced by alternatives. A fuel cell is a major contender to replace existing fossil fuel dependency. A fuel cell vehicle uses an electric traction system coupled to a single-speed drive, powered with a Li-Ion Battery or a supercapacitor and a PEM-based Fuel Cell power system, instead of an IC engine. An electric powertrain requires an energy system with high volumetric and gravimetric energy and power density. The prime objective of the present work is to develop an electric drive train suitable for light-duty vehicles based on compressed hydrogen storage and fuel cells.

Uniqueness of the Solution: Conventional graphite plates used in fuel cells have the limitation of high gravimetric and volumetric power density. In the present work, the team has replaced the graphite bipolar plate with a lightweight metallic bipolar plate which substantially reduces the weight and volume of the fuel cell system. They have designed a metallic bipolar and developed a lightweight fuel cell stack suitable for automobile applications. They have also developed a Balance of Plant (BoP) for the fuel cell stack, suitable for light-duty vehicles. They have explored a lightweight gas distribution system to achieve desired gravimetric and volumetric power density. The flow field design is also crucial for performance. The optimum flow field will be designed to minimise water flooding and improve the current density distribution.

Current Status of Technology: The technology is ready with all the components required for the fuel cell stack, tested in the laboratory. The subsystem necessary for the fuel cell and the BoP is completed. The team is in the process of finding an electric vehicle to retrofit their system.

Societal Impact: Green hydrogen is expected to be one of the few areas India has recently taken steps to keep itself at par with global technology leaders. Fuel cells are considered as potential alternatives for future green mobility.

Patent(s): In Process

Relevant Industries: Clean Energy, Renewables, Automotives, Metals.

Faculty: Prof. Prakash C Ghosh, Energy Science & Engineering.