

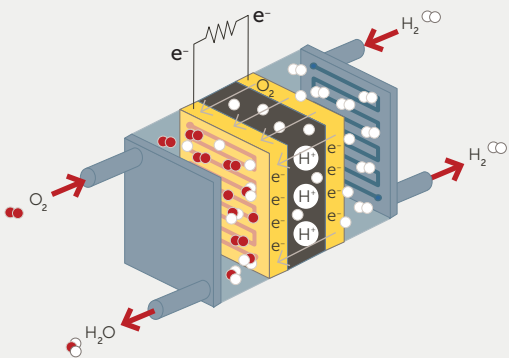
# Protect Your Fuel Cells from Gas-Phase Contamination

## Do You Maximize Fuel Cell Performance?

Fuel cells are devices that convert chemical energy into electrical energy and are frequently used in sustainable power solutions for automobiles and stationary systems.

The most commonly used proton exchange membrane (PEM, also called polymer electrolyte membrane) fuel cell converts hydrogen into water vapor by using the oxygen from ambient air.

Ambient air and supply hydrogen, however, can contain hundreds of contaminants. Maximizing the purity of air and hydrogen is essential for optimized fuel cell performance.



### THE PROBLEM

Operating fuel cell power systems requires a supply of hydrogen from a dedicated storage tank as well as a supply of oxygen from ambient atmospheric air. For automotive applications, hydrogen is stored in fuel tanks and air is drawn in from the outside.

On the supply side for hydrogen, the ISO 14687:2019 standard defines tolerable contaminant levels and suppliers will provide that. However, optimized fuel cell performance may require further purification at the engine level.

On the operational side, ambient air is filled with nitrogen, sulfur, and carbon oxides from internal combustion engines, as well as hundreds of other airborne molecular contaminants (AMC), which are gas-phase chemicals that can impact fuel cell performance.

The most common contaminants that impact PEM fuel cell performance are listed in Table 1.

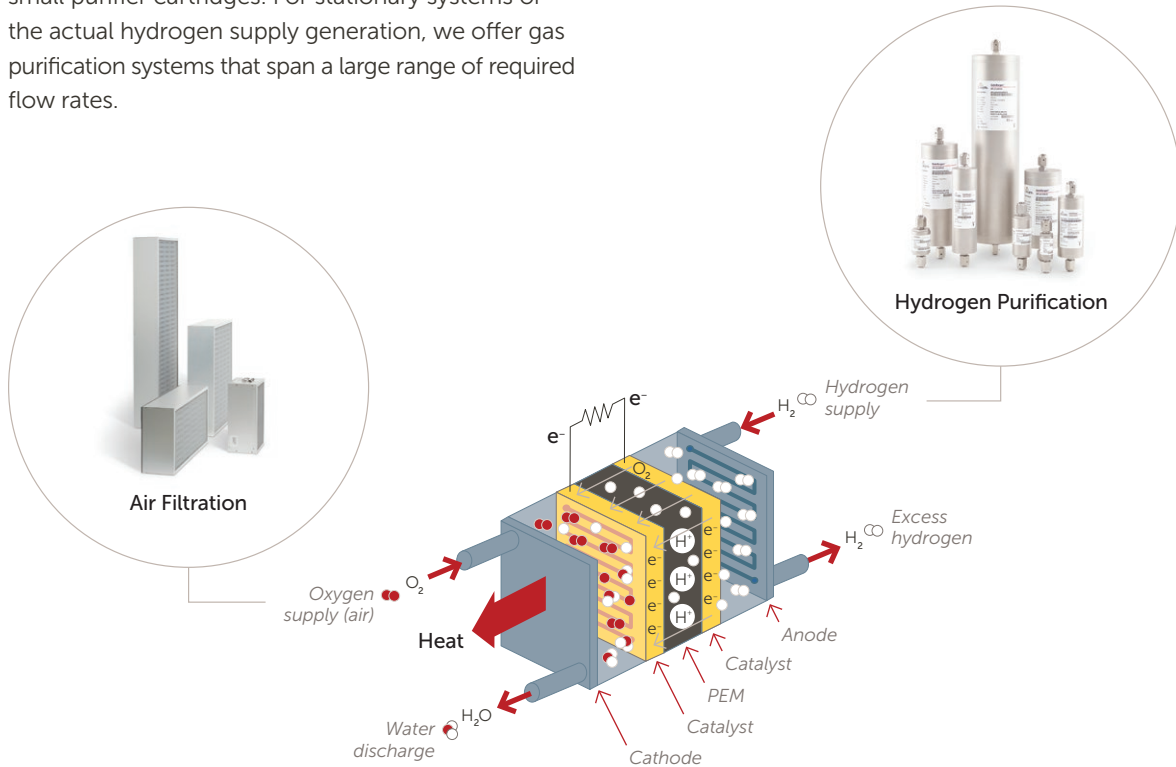
Contaminant	Typical air concentration	Tolerable concentration	Impact	Removal
Nitrogen oxides NO, NO <sub>2</sub>	ppm level	ppb level	Inhibiting H <sub>2</sub> conversion	AMC filter, gas purifier
Ammonia, NH <sub>3</sub>	Mid to high ppb level	Low ppb level	Degrades electrolyte	AMC filter, gas purifier
Carbon monoxide, CO	ppm level	200 ppb or less	Poisons catalyst	Air getter, gas purifier
Sulfur dioxide and trioxide, SO <sub>2</sub> , SO <sub>3</sub> , other sulfur species	Mid ppb level	Low ppb level	Poisons catalyst	AMC filter, gas purifier
Organic gases	ppm level	ppb level	Can react with hydrogen	AMC filter, gas purifier
Acidic gases	ppb level	Low ppb level	Can impact membrane	AMC filter, gas purifier
Salt (NaCl)	Wintertime	low	Reduces protonic activity	Particle filter

Table 1

## ENTEGRIS SOLUTIONS

Entegris provides product solutions for both the supply and operational sides of fuel cell systems.

For hydrogen purification, end users can implement small purifier cartridges. For stationary systems or the actual hydrogen supply generation, we offer gas purification systems that span a large range of required flow rates.



For the air filtration on the operational side, manufacturers can remove AMC with Entegris AMC filters. Form factors for personal automobiles and trucks, as well as stationary systems, are available.

Filtration and purification systems are validated with our ISO 17025 accredited worldwide [Analytical Services](#), which are also available for in-field deployments.

### LEARN MORE

No other company has both the expertise and experience to provide transformative new solutions for your processes. For more information, please contact [customer service](#).



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