



PEMION® FUEL CELL OFFERINGS

Proton Exchange Membranes & Polymers

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PRODUCT INFORMATION

Ionomr designs and manufactures breakthrough advanced ion-exchange materials to enable rapid growth of the hydrogen economy. Ionomr's advanced proton exchange membranes and polymers are a breakthrough in material science with a uniquely stable hydrocarbon structure, making it the only product of its kind.

Pemion® represents a fundamental shift in the approach to proton exchange technology through its migration from fluorinated PFAS chemistry to hydrocarbon materials, providing substantially lower gas crossover and eliminating PFAS-related environmental and end-of-life issues at considerably higher performance.

Pemion® enables major efficiency and performance gains, while aligning with needs of the renewable economy. It is the only environmentally friendly option on the market.

Produced on reinforcement at thicknesses competitive to leading PFSA membranes in the industry, Pemion® provides leading conductance and durability without compromise.

For use in fuel cell applications including heavy duty transport & automotive, hydrocarbon based Pemion® membrane and ionomer offers several advantages over incumbent perfluorinated materials to increase the efficiency, versatility, and lifetime of fuel cell engines, including: lower gas crossover for increases to range and the lifetimes of both membrane and catalyst; higher proton conductivity for additional gains to efficiency and power density; significantly greater temperature stability to enable many system design benefits; & a substantially easier end-of-life precious metal recovery, reducing costs & eliminating the environmental concerns specific to acidic perfluorinated compounds.

PEMION® REINFORCED MEMBRANES — PRE-PRODUCTION

Thickness and Basis Weight Properties

Membrane Type	Typical Thickness (µm)		Basis weight (g/m ²)
PF1-HLE9-15-X	15		18
Physical Properties ¹	MD	TD	Test Method
Tensile Strength, MPa	65 - 95	90 - 100	ASTM 638
Young's Modulus, MPa	600 - 750	650 - 820	ASTM 638
Elongation to break	65 - 105%	60 - 90%	ASTM 638
Hydrolytic Properties ²			
Water Uptake, wt%:	110 - 160%		ASTM D570
Linear Expansion			
to water soaked, 22 °C	< 7%		ASTM D570
to water soaked, 80 °C	< 7%		ASTM D570
Z-Expansion			
to water soaked, 22 °C	< 150%		ASTM D570
to water soaked, 80 °C	< 250%		ASTM D570
Electrochemical Properties ³			
Area Resistance	< 50 mΩ · cm ²		
Hydrogen Crossover Current	< 1.5 mA/cm ²		Atmospheric
	< 5 mA/cm ²		150 kPa gauge
Measured In-plane Conductivity ⁴	80°C	30°C	
Conductivity, 95% RH	140 mS/cm	> 90 mS/cm	
Conductivity, 50% RH	5 mS/cm	5 mS/cm	
Reference:	80°C	30°C	
NR211, 95% RH	90 mS/cm	70 mS/cm	
NR211, 50% RH	11 mS/cm	3 mS/cm	
Other Properties			
Specific Gravity	1.2 g/cm ³		
Maximum Processing Temperature	105 °C		
Polymer Tg	> 300 °C		

Note: These are prototype materials only intended to be used for early development activities and not intended for production items. Product information is to be used as a guide only, not as a design specification, and is subject to change at any time as part of ongoing product development. Ionomr makes no warranties, express or implied, and assumes no obligation or liability in connection with any use of this information or for results obtained in reliance thereon.

- 1 Measured at 22 °C in atmospheric condition
- 2 Measured from dried to equilibrated in DI water at 22 °C
- 3 Measured at 80 °C via chronoamperometry, water-wet (100% RH)
- 4 Electrochemical properties reported for unreinforced membranes based on in-plane conductivity measurements by EIS. NR211 & Pemion measured under identical conditions.

Document ID	Title		
FM-6027-A	Properties of Pemion® Hydrocarbon Proton Exchange Membrane		
Revision	Prepared By	Approved By	Effective Date
A	Omid Toussi	Ben Britton	March 12, 2021

This document is reviewed to ensure its continuing relevance to the systems and process that it describes.

REVISION HISTORY:

Revision	Date	Description of Changes	Approved By
A	March 12, 2021	Initial Draft	Ben Britton