PEMION® REINFORCED MEMBRANES — PRE-PRODUCTION

Thickness and Basis Weight Properties

Membrane Type	Typical Thickness (µm)		Basis weight (g/m²)
PF1-HLF8-15-X	15		18
Physical Properties[1]	**MD**	**TD**	**Test Method**
Tensile Strength, MPa	> 50	> 50	ASTM 638
Young's Modulus, MPa	> 600	> 600	ASTM 638
Elongation to break	> 50%	> 50%	ASTM 638
Hydrolytic Properties[2]			
Water Uptake, wt%:			ASTM D570
to water soaked, 22 °C	110 - 140%		
to water soaked, 80 °C	150 - 190%		
Linear Expansion			ASTM D570
to water soaked, 22 °C	< 7%		
to water soaked, 80 °C	< 11%		
Z-Expansion			ASTM D570
to water soaked, 22 °C	< 140%		
to water soaked, 80 °C	< 190%		
Electrochemical Properties[3]			
Area Resistance	< 42.5 mΩ · cm²		
Hydrogen Crossover Current	< 2.0 mA/cm²		Atmospheric
	< 6.0 mA/cm²		150 kPa gauge
Measured Ex-situ Conductivity[4]	**In-plane**	**Through-plane**	
PF1-HLF8-15-X	> 100 mS/cm	> 90 mS/cm	
Reference:	**In-plane**	**Through-plane**	
NR211 (for reference only)	60 ± 5 mS/cm	60 ± 5 mS/cm	
15 µm Reinforced PFSA (for reference only)	65 ± 5 mS/cm	44 ± 4 mS/cm	
Other Properties			
Specific Gravity	1.3 g/cm³		
Maximum Processing Temperature	160 °C		
Maximum Fuel Cell Operating Temperature	110 °C		
Polymer Tg	> 300 °C		

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ORDERING INFORMATION

Part Number	Description
PF1-HLF8-15-X-032	Pemion® 15µm Reinforced Proton Exchange Membrane Roll, 32cm width
PF1-HLF8-15-X-0A4	Pemion® 15µm Reinforced Proton Exchange Membrane, A4 sheet

PEMION® IONOMERS: DRY RESIN

Ionomer Type	IEC[5] (meq/g)	EW (g/eq.)	Density (g/cm³)	Solubility[6]
PP1-HNN8-00	2.8 - 3.1	320 - 360	1.2	Alcohols and alcohol/water mixtures
Ionomer Type (reference)	**IEC[1] (meq/g)**	**EW (g/eq.)**	**Density (g/cm³)**	**Solubility**
Long side-chain PFSA (for reference only)	0.9 - 1.0	1000 - 1,100	2.0	Alcohols and alcohol/water mixtures
Short side-chain PFSA (for reference only)	1.1 - 1.3	770 - 910	2.0	Alcohols and alcohol/water mixtures

Notes

These materials are only intended to be used for development activities and not intended for production items. Product information is to be used as a guide (reference data) only, and not as a design specification. Product information 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] Membranes equilibrated at 22 °C under atmospheric condition for 24 h prior to measurement.
[2] Measured from dried to fully equilibrated in de-ionized water, at the specified temperatures.
[3] Measured *in-situ* via chronoamperometry at 80 °C, 100/100% RH (anode/cathode).
[4] Membranes equilibrated in de-ionized water at 22 °C for 24 h prior to measurement. Measured *ex-situ* using electrochemical impedance spectroscopy. Pemion and reference membranes measured under identical conditions.
[5] IEC of polymer powder measured as-received.
[6] Refer to APN-PEM-1004 for additional information.

RELATED DOCUMENTS

ID	Title
APN-PEM-1003	Pemion® Membrane Handling, Storage, and Pre-Treatment
APN-PEM-1004	Pemion® Ionomer Handling, Dispersion, and Ink Formulation
APN-PEM-1007	Pemion® Fuel Cell Assembly and Testing Reference Design

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