IONOMR INNOVATIONS

AEMION+® Next Generation ELECTROLYSIS OFFERINGS

Anion 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 Aemion+ anion exchange membranes are significantly more durable than our competitor's leading to thinner membranes, longer service life and reduced overall system costs.

Our membranes have low ionic resistance, high electrical resistance, and strong chemical stability in solutions of both high and low pH, including concentrated alkaline solutions **from 0.1M to 5 M at 95 °C.**

Ionomr's advanced anion exchange membranes and polymers are a breakthrough in material science with a unique hydrocarbon structure and the strongest alkaline stability available. Aemion+® provides specialized solutions for OEMs with unique application challenges.

Aemion+® represents a fundamental shift in anion exchange technology. Through Aemion+®, we provide a platform to enable simultaneous performance and lifetime improvements in clean technologies while further reducing their environmental impact.

For use in electrolysis applications including AEM water electrolysis & CO_2 Electrolysis, hydrocarbon based Aemion+® membranes and polymers can be utilized in the required conditions and paired with its high performance, unlocks many end use applications that were previously constrained by the membrane's instability.

Aemion+® enables electrochemical systems without the need for precious metals (commonly platinum and iridium), providing a pathway for the production of energy-efficient and low-cost green hydrogen as well as profitible carbon capture and utilization technologies.

AEMION+® REINFORCED MEMBRANES — PRELIMINARY

Thickness and Reinforcement Properties

Membrane Type	Typical Thickness (µm)	IEC[1] (meq/g)	Reinforcement
AF3-CLF9-50-X	50	1.9-2.7	Woven PTFE

Physical Properties[2]	MD	TD	Test Method
Tensile Strength, MPa	> 55	> 55	ASTM 638
Young's Modulus, MPa	> 200	> 150	ASTM 638
Elongation to break, %	100 - 150	100 - 150	ASTM 638
Hydrolytic Properties[3]			
Water Uptake			
to water soaked, 80 °C	< 25%		ASTM D570
Linear Expansion			
to water soaked, 80 °C	< 3%		ASTM D570
Z-Expansion			
to water soaked, 80 °C	< 20%		ASTM D570
KOH stability			
to water soaked, 80 °C, 0.1M & 1M KOH, 24 hours	<3wt%		
to water soaked, 80 °C, 0.1M & 1M KOH, 7 days	<3wt%		
Electrochemical Properties			
Hydrogen permeability, $N\mu L.cm^{-2}\ min^{-2}.\ bara^{-2}$	< 5		Note[4]
Chemical Stability			
Max. Recommended Condition	5 M KOH, 95 °C		Internal[5]
Other Properties			
Maximum Processing Temperature	150 °C		
Polymer Tg	> 300 °C		
Counter-ions	I^-/Cl^-		

Notes

1 Polymer IEC in the hydroxide (OH-) counter-ion form calculated by NMR. Recommend silver nitrate titration once receive the memrbane.
2 Measured at 22 °C in atmospheric condition
3 Measured from dried to equilibrated in DI water at 22 °C
4 Not a standard test. Hydrogen permeability is measured in internal testing condition for reference only and is not necessarily representative of customer conditions. It is recommended to verify permeability in individual systems once received.
5 Measured ex-situ by change in mechanical strength, conductivity & IEC after soaking electrolyte

AEMION+® IONOMERS: DRY RESIN

Ionomer Type	IEC[1] (meq/g)	Conductivity Cl^- (mS/cm)	Water Uptake[2] OH^- (%)	Water Uptake[2] Cl^-/I^- (%)
AP3-HNN9-00	1.9-2.7	4 - 9	20 - 50	10 - 15

Notes

1 IEC in the hydroxide (OH^-) counter-ion form, calculated by NMR. Recommend silver nitrate titration once receive the memrbane.
2 Approximate swelling properties when cast into membrane form at 25 - 50 µm, at 80°C.

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, subject to change at any time.

Document ID	Title		
FM-6065-01	Properties of Next-Gen Aemion+™ Water Electrolysis Membranes		
Revision	**Prepared By**	**Approved By**	**Effective Date**
1	Tong Li	Scott McDermid	Sept 15, 2022

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
1	Sept 15, 2022	Initial Draft	Scott McDermid

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