

HYPROOF
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HYPROOF
TECHNOLOGY
Product Brochure

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Membrane Technology Smart Manufacture

No.XNY202405

Profile

Hyproof Tech. was founded in 2016. Focusing on overseas scientists and advanced technology, Hyproof Tech. is committed to research, development, production and sales of novel fluorinated materials for hydrogen energy use, reinforced nano-microporous membranes and other products. It is used in new energy, carbon neutrality, safety protection, industrial microelectronics and other fields. Hyproof Tech. is a high-tech enterprise, which is recognized as "specialized and new enterprise" by government, and participate in hydrogen energy vehicle fuel cell membrane electrode and batch preparation technology, water electrolysis to make high voltage hydrogen electrolytic reactor and key technologies of the system and other major national projects.

Headquartered in Shanghai, Hyproof Tech. has five subsidiaries, a collection of R&D, production, sales and service enterprises.

Hyproof Tech. takes "scientific and technological innovation" as its core competitiveness, with scientists of many years of experience in the technology of reinforced nano-microporous membrane materials, product design, development and commercialization. The company has about 40 invention patents and utility patents, including nearly 30 invention patents (8 foreign invention patents). Form a complete product and service system integrating independent original core technology, core products and system solutions.



Hyproof Tech. has three business divisions according to product application fields: Renewable energy, industrial, functional textile.

"Membrane Technology, Smart Manufacture", perfectly shows the entrepreneurial spirit of Hyproof people's aggressiveness, innovation in science and technology to serve the world. All Hyproof people will uphold the conception of "powering better Earth with science and technology, and escorting a beautiful environment with new materials", striving to be the leader in the new material industry!

HYPROOF

Perfluorinated Sulfonic Acid Resin



Product Description

- Perfluorosulfonic Acid Ion-Exchange Resin is a special fluorine-containing polymer with excellent stability and chemical resistance, widely used in fuel cells, flow batteries, lithium-ion rechargeable batteries, hydrogen electrolyzer, chlor-alkali industry electrolyzer equipment, sewage disposal, chemical catalysis, photocatalysis, gas separation, functional composite materials and other fields.

Specification	HMS-18-F	HMS-19-F	HLR-1890	HLR-1990
PFSA Content (Long side chain), wt%	≥99		≥90	
Ionic Exchange Equivalent Weight, g/mol	800-900	900-1000	800-900	900-1000
Other Content, %	Water ≤1%		Water ≤10%	
Melt Flow Index(MFI)	<5 (g/10min)		/	
Appearance	Particle		Powder	

Application Scenarios&Storages

- Used to produce ion exchange conductive membranes and MEA required in various electrolysis units, fuel cells and flow batteries, and can also be used as super acid catalysts and ultra-stable ion exchangers during organic synthesis process.
- Store in a sealed package.
- Store in a clean and dry environment, away from direct sunlight. The recommended storage temperature is 25±5°C/77±9°F.

Test Requirements

- Place the product in a laboratory environment(23±2°C/73.4±3.6°F, 50±5% RH) for at least 24 hours before testing.
- Test temperature: 270°C/518°F, counter weight 2160g.
- Test after resin transformation treatment. Testing method follows the Chinese national standard "GB/T 20042.3-2022".

Dispersing Instructions

1. Please confirm the product model, exchange equivalent and solid content of the resin according to the label provided (Note: perfluorosulfonic acid resin is hygroscopic, and the resin moisture content is about 10%);
2. Please prepare the solvent in advance and pre-mix it. It is recommended to use n-propanol and water as solvent for dispersion, with a solvent mass ratio of 1:1;
3. The recommended solid content range for the dispersion is 0.1%-30% ;
4. When weighing the resin, please pay attention to changes in the ambient temperature and humidity. It is recommended to perform the weighing in a laboratory environment, with a controlled temperature at $23\pm 2^{\circ}\text{C}$ and a relative humidity of $50\pm 5\%\text{RH}$. Large temperature and humidity changes lead to changes in the moisture content of the powder, ultimately resulting in deviation of the solid content of the dispersion;
5. The preparation of the dispersion can be carried out without any additional heating or inert gas protection. During the process of adding the resin to the solvent, it is recommended to use magnetic or mechanical stirring to ensure a thorough mixture of the powder and solvent;
6. To prepare a dispersion with a solid content $\geq 10\%$, please add the powder to the stirred solvent multi times, avoiding of sticking the powder to the container wall;
7. The dispersion solid content decides the stirring time. It is recommended to stir for not less than 4 hours when preparing dispersions with solid content $< 10\%$, and not less than 8 hours when preparing dispersions with solid content $> 10\%$;
8. If large particles are found in the dispersion when practicing particle size test ($\geq 1\mu\text{m}$), please contact Hyproof custom service.

Perfluorosulfonic Acid Resin Dispersion



Product Description

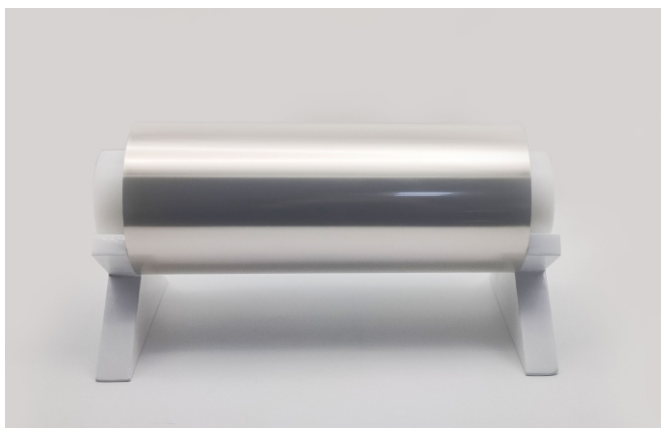
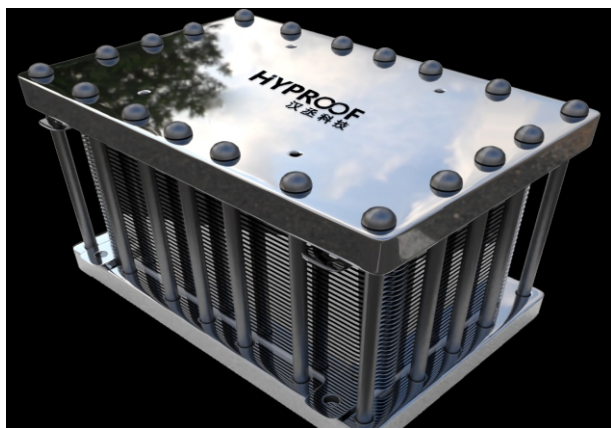
1. Hyproof has independent intellectual property right of perfluorinated sulfonic acid resin.
2. Hyproof's related products are widely used in CCM membrane electrode slurry production, PEM production, special electrochemical binders and other fields.
3. Hyproof supports customization. Customers can choose different dispersion systems, polymer content and ion exchange equivalents to achieve the optimal selection to meet the needs of customers.

Specification	HLD-1805	HLD-1820	HLD-1905	HLD-1920
PFSA Content (Long side chain), wt%	5 ± 0.1	20 ± 0.1	5 ± 0.1	20 ± 0.1
VOC Content, wt%	55 ± 1	45 ± 1	55 ± 1	45 ± 1
Water Content, wt%	40 ± 1	35 ± 1	40 ± 1	35 ± 1
Ionic Exchange Equivalent Weight, g/mol	800-900		900-1000	
Viscosity, mPa·s	10-20	50-300	10-20	50-300
Application Scenarios	Used to produce ion exchange conductive membranes and MEA required in various electrolysis units, fuel cells and flow batteries, and can also be used as super acid catalysts and ultra-stable ion exchangers during organic synthesis process.			

Storages

- Store in a clean and dry environment, away from direct sunlight. The recommended storage temperature is $25\pm 5^{\circ}\text{C}/77\pm 41^{\circ}\text{F}$.

Proton Exchange Membrane for Water Electrolysis



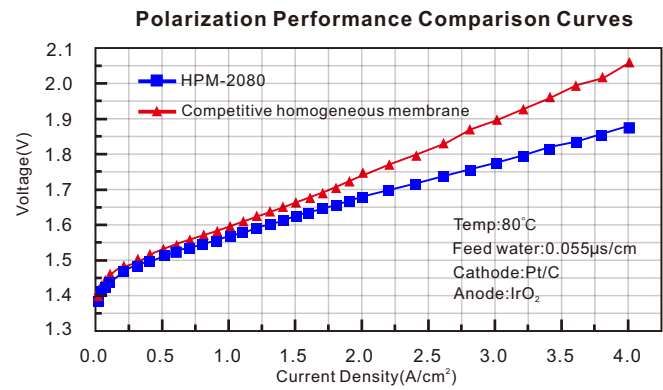
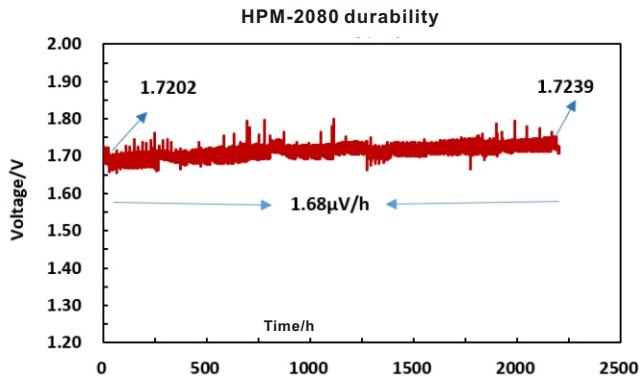
Product Description

- The HPM series proton exchange membrane for water electrolysis is reinforced perfluorosulfonic acid proton exchange membrane (PEM). It has properties of high proton conductivity, high selectivity and high stability in both acidic and corrosive environments, and is widely used in electrolyzer. It is identified by membrane type and identification number (batch number).

Specification	HPM-2050		HPM-2080		HPM-20110	
Thickness, μm	50 \pm 2		80 \pm 3		110 \pm 4	
Density, g/cm^3	2.0 \pm 0.05					
Ionic Exchange Equivalent Weight, g/mol	900-1000					
Proton Conductivity, mS/cm	\geq 70					
Tensile Strength, MPa	TD	MD	TD	MD	TD	MD
	\geq 35	\geq 35	\geq 35	\geq 35	\geq 30	\geq 30
Breaking Elongation, %	\geq 100					
Linear Swelling Rate (25 $^{\circ}$ C/24h), %	\leq 5					
Linear Swelling Rate (80 $^{\circ}$ C/1h), %	\leq 5		\leq 5		\leq 6	
Test Standards	GB/T 20042.3-2022					

Test Requirements

- Before testing, please place the membrane samples in a laboratory environment (23 \pm 2 $^{\circ}$ C/73.4 \pm 3.6 $^{\circ}$ F, 50 \pm 5%RH) for 24h;
- Test condition is 25 \pm 2 $^{\circ}$ C/77 \pm 3.6 $^{\circ}$ F, 100%RH;
- It is tested with 10mm rectangular sample, tensile rate: 50mm/min.



Suggested Activation Methods

On-line Activation Process:

1. After finishing production process of CCM, please keep the CCM dry, seal it and then place it in the electrolyzer;
2. Cycle pure water at a certain temperature (80°C/176°F) into the anode side of the electrolyzer, and activated for 4 hours with low current (1→2A).

Notes

1. Keep the membrane package closed/sealed before use;
2. Open the package and handle it in a clean and dust-free area in use, all surfaces in contact with the membrane must be smooth and flat (experimental gloves must be worn during operation);
3. Store the membrane in its original packaging and stack horizontally to avoid prolonged exposure to light or high temperatures (> 40°C/104°F) after use.

Delivery Methods

Product information: Products are cut as required at (23±2°C/73.4±3.6°F, 50±5%RH). The fluctuation of ambient temperature and humidity will cause the size change of the membrane. It is recommended to confirm the membrane size requirements with customer service before shipping.

1. The standard size of sheet product includes:

Width: 0.2m - 0.6m

Length: 0.2 m - 0.6m

2. The standard size of roll product includes:

Standard width of roll product: 0.31m and 0.62m

Standard length of roll product: 50m - 100m

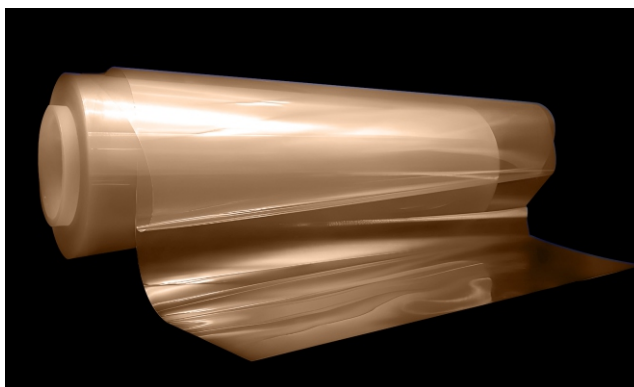
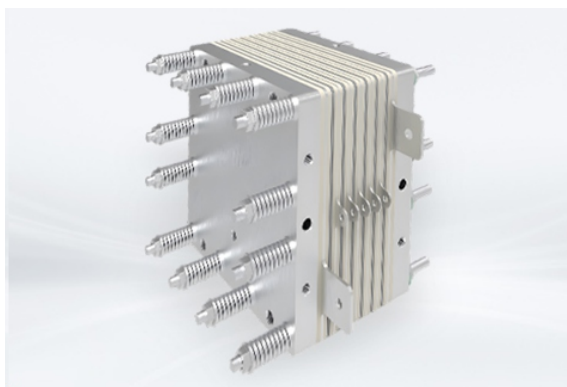
3. For non-standard customized size:

Roll width for special orders is 0.2m - 1.2m, minimum order requirement is 100m² (note: special requirements will add additional cost and lead time).

4. Transportation mode: The product is delivered in form of flat sheet or roll. Before use. Please contact customer service if you have special needs.



Water Electrolysis Anion Exchange Membrane



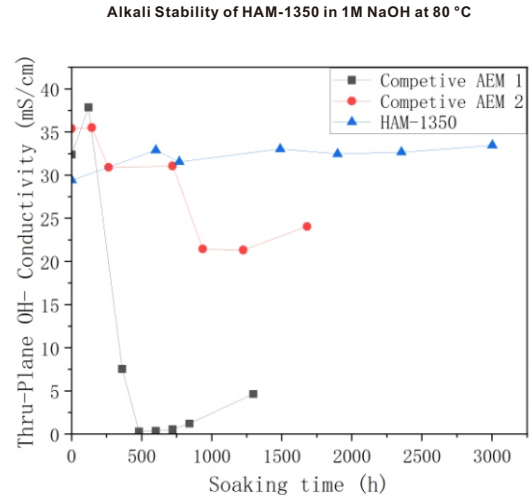
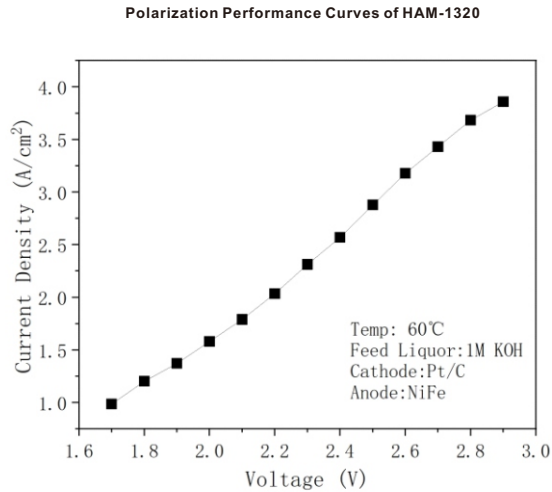
Product Description

- In response to the demand for hydrogen production through electrolysis of water, the independently developed HPA series enhanced anion exchange membrane (AEM) has excellent thermal, chemical, and mechanical stability. Even at low alkaline concentrations, it can achieve high ion conductivity, making the hydrogen production process more stable, economical, and efficient. It is identified by membrane type and identification number (batch number).

Specification	HAM-1320		HAM-1350	
Thickness (Dry), μm	20 \pm 1.5		50 \pm 2.5	
Ionic Exchange Equivalent Weight, g/mol	1.9-2.3		1.6-1.9	
Linear Swelling Rate (25°C/24h), %	≤ 2			
Water Uptake, %	≥ 10		≥ 15	
Tensile Strength, MPa	TD	MD	TD	MD
	≥ 40	≥ 40	≥ 30	≥ 30
Breaking Elongation, %	≥ 90			
Area Resistance, (25°C Cl ⁻)m Ω .cm ²	≤ 200		≤ 400	
Area Resistance, (25°C OH ⁻)m Ω .cm ²	≤ 100		≤ 210	
In-Plane Cl ⁻ Conductivity, mS/cm	≥ 13		≥ 11	
In-Plane HCO ₃ ⁻ Conductivity, mS/cm	≥ 7		≥ 6	
Recommended Condition	0.5M KOH, $\leq 80^\circ\text{C}$			

Test Requirements

1. Polymer IEC in the hydroxide (OH⁻) counter-ion form;
2. Measured in DI water;
3. Measured from dried to equilibrated in DI water at 25 °C;
4. Tested with 10mm rectangular sample, tensile rate: 50mm/min.



Pre-treatment Methods

1. For optimal results, please remove the membrane from the backing film before using and immerse it in a large amount of excess 0.5M KOH aqueous solution. These exchanges can be carried out at ambient temperature or 80 °C, the exchange effect will be better at 80 °C ;
2. Please try to minimize the exposure time of the hydroxide form anion exchange membrane in the air, as CO₂ in the air can affect the initial performance of the membrane;
3. After exchanging to hydroxide form anion exchange membrane, in order to avoid changes in membrane size, please do not immerse the membrane in deionized water;
4. If it is necessary to clean the membrane, please use KHCO₃ solution of similar concentration as the washing solution.

Notes

1. Please store, handle, and process the membrane in a clean and dust-free environment;
2. When cutting the membrane, please use a new sharp knife or blade. When handling the membrane, please be sure to wear protective gloves and do not puncture, wrinkle, or scratch the membrane. Please keep all surfaces in contact with the membrane smooth and clean during handling, inspection, storage, pretreatment, and installation;
3. When stored for a long time, dry membrane should be stored in a sealed state, and wet membrane should be stored in a 3 wt% KHCO₃ solution to avoid microbial contamination.

Delivery Methods

Product information: Products are cut as required at (23±2°C/73.4±3.6°F, 50±5%RH). The fluctuation of ambient temperature and humidity will cause the size change of the membrane. It is recommended to confirm the membrane size requirements with customer service before shipping.

1. The standard size of sheet product includes:

Width: 0.2m - 0.6m

Length: 0.2 m - 0.6m

2. The standard size of roll product includes:

Standard width of roll product: 0.31m and 0.62m

Standard length of roll product: 50m - 100m

3. For non-standard customized size:

Roll width for special orders is 0.2m - 1.2m, minimum order requirement is 100m² (note: special requirements will add additional cost and lead time).

4. Transportation mode: The product is delivered in form of flat sheet or roll. Before use. Please contact customer service if you have special needs.

Proton Exchange Membrane for Fuel Cell



Product Description

- The HPM series proton exchange membrane for fuel cell is reinforced perfluorosulfonic acid proton exchange membrane (PEM). It has properties of high proton conductivity, high selectivity and high stability in both acidic and corrosive environments, and is widely used in fuel cell. It is identified by membrane type and identification number (batch number).

Specification	HPM-1806		HPM-1809		HPM-1812		HPM-1815	
Thickness, μm	6 \pm 0.5		9 \pm 0.5		12 \pm 1.0		15 \pm 1.0	
Density, g/cm ³	2.05 \pm 0.05							
Ionic Exchange Equivalent Weight, g/mol	950-1050		950-1050		950-1050		950-1100	
H ₂ Crossover Rate, cm ³ /cm ² *min	<0.01							
Tensile Strength, MPa	TD	MD	TD	MD	TD	MD	TD	MD
	≥ 60	≥ 60	≥ 50	≥ 50	≥ 50	≥ 50	≥ 40	≥ 40
Breaking Elongation, %	≥ 80		≥ 100		≥ 100		≥ 100	
Elastic Modulus, MPa	≥ 250							
Linear Swelling Rate(25°C/24h), %	≤ 3							
Linear Swelling Rate(80°C/1h), %	≤ 3							
Test Standards	GB/T 20042.3-2022							

Test Requirements

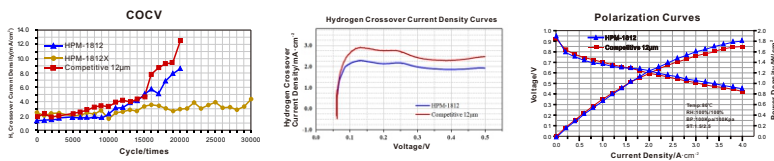
- Before testing, please place the membrane samples in a laboratory environment (23 \pm 2°C/73.4 \pm 3.6°F, 50 \pm 5%RH) for 24h;
- It is tested with 10mm rectangular sample, tensile rate: 50mm/min.

Activation Methods

It is recommended to refer to the description of section 6.6 of "GB/T 20042.5-2009 Proton Exchange Membrane Fuel Cell Part 5: Test Methods for Membrane Electrode" for single-cell activation. The steps are as follows:

1. Install the single cell on the fuel cell test platform;
2. Use the reactive gas as the activation medium, the activation process is according to the following operating conditions:
 - Reaction temperature I: 75°C/167°F;
 - Relative humidity of reaction gas (RH): 100%;
 - Stoichiometric ratio of reaction gas: St H₂: 1.2, St Air: 2.5;
 - Outlet back pressure: 0.1MPa;
 - Current density of operating: $i \geq 500 \text{ mA/cm}^2$;
 - Running time: $\geq 4 \text{ h}$;

Note: The activation conditions of the cell can also be carried out according to the customer's standards, or by mutual agreement.



Delivery Methods

Product information: Products are cut as required at ($23 \pm 2^\circ \text{C}/73.4 \pm 3.6^\circ \text{F}$, $50 \pm 5\% \text{RH}$). The fluctuation of ambient temperature and humidity will cause the size change of the membrane. It is recommended to confirm the membrane size requirements with customer service before shipping.

1. The standard size of sheet product includes:

Width: 0.2m - 0.6m

Length: 0.2 m - 0.6m

2. The standard size of roll product includes:

Standard width of roll product: 0.31m and 0.72m

Standard length of roll product: 100m and 200m

3. For non-standard customized size:

Roll width for special orders is 0.2m - 1.2m, minimum order requirement is 100 m^2 (note: special requirements will add additional cost and lead time).

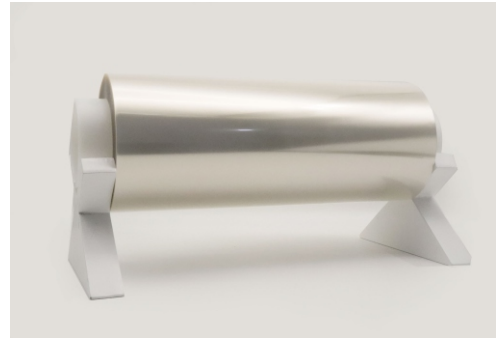
4. Transportation mode: The product is delivered in form of flat sheet or roll. Before use. Please contact customer service if you have special needs.

Notes

1. Keep the membrane package closed/sealed before use;
2. Open the package and handle it in a clean and dust-free area in use, all surfaces in contact with the membrane must be smooth and flat (experimental gloves must be worn during operation);
3. Store the membrane in its original packaging and stack horizontally to avoid prolonged exposure to light or high temperatures ($> 40^\circ \text{C}/104^\circ \text{F}$) after use.



Proton Exchange Membrane for Flow Battery



Product Description

- The HPM series proton exchange membrane for flow battery is reinforced perfluorosulfonic acid proton exchange membrane (PEM). It has properties of high proton conductivity, high stability, and high vanadium ion barrier in both acidic and corrosive environments, and is widely used in flow batteries. It is identified by membrane type and identification number (batch number).

Test Requirements

- Before testing, please place the membrane samples in a laboratory environment ($23\pm 2^{\circ}\text{C}/73.4\pm 3.6^{\circ}\text{F}$, $50\pm 5\%\text{RH}$) for 24h.

Specification	HPM-2050L		Test Standards
Thickness, μm	50 \pm 2		GB/T 20042.3-2022
Density, g/cm^3	2.05 \pm 0.05		
Ionic Exchange Equivalent Weight, g/mol	950-1100		
Tensile Strength, MPa	TD	MD	
	≥ 30	≥ 30	
Breaking Elongation, %	≥ 100		
Linear Swelling Rate (Hydrochloric Acid 3M, $25^{\circ}\text{C}/1\text{h}$)	≤ 3		
Linear Swelling Rate (Hydrochloric Acid 3M, $80^{\circ}\text{C}/1\text{h}$)	≤ 5		
Anti-puncture Force, gf	≥ 500		GB/T 37841-2019

HYPROOF TECHNOLOGY

Pioneer Membrane Manufacture of
Advanced Reinforced
Ion Exchange Membrane



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