Developing New Electrolysis Membranes for a Better, Cleaner Future

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AGC Chemicals Company Position in the Hydrogen Economy

PEMWE is a leading technology in converting electrical power into hydrogen. It has excellent responsivity, a wide operation range, and can produce pressured pure hydrogen.

AGC's FORBLUE™ product family has over 50 years of experience in ion-exchange membranes (IEMs). Starting in the chlor-alkali electrolysis application, the IEM technology was further developed for the PEMWE industry.

History of AGC's Fluorochemicals Business

1933
Start of caustic soda production (chemical process)

1950
Begins R&D on the **SELEMION** membrane, an ion exchange membrane for electrolysis and electrodialysis

1962
Starts research into fluoropolymers and launches **SELEMION** as a commercial product, which, depending on the application, can generate a small amount of hydrogen gas

1964
Begins fluorochemicals business (fluorocarbons)

1975
Launches **FLEMION**, an ion exchange membrane for the chlor-alkali industry, generating hydrogen gas a biproduct

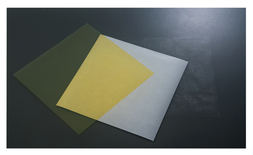
1978
Starts ion exchange membrane (IEM) plant operation (AZEC electrolyzer)

2001
Discontinued electrolyzer business and focus on IEM business

2017
Introduces the **FORBLUE** family of separation and ion exchange functional products: **FLEMION, SELEMION, S-SERIES, i-SERIES and sunsep**

AGC Separation Functional Products Brand

FORBLUE™ SELEMION
Salt production / Desalting / Water production / Acid recovery



Hydrocarbon ion exchange membrane

FORBLUE™ FLEMION
Caustic soda production / Caustic potash manufacturing

Perfluoro ion exchange membrane

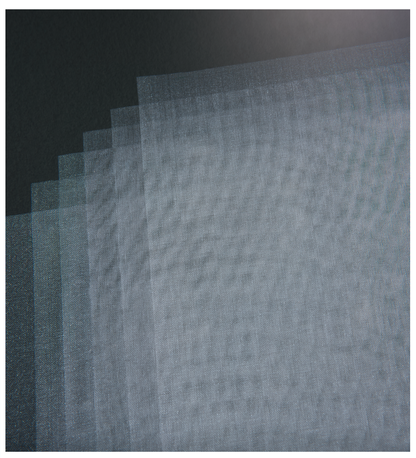
FORBLUE™ sunsep
Dehumidification / Humidification of gas

Perfluoro sulfonic acid tube

FORBLUE™ i-SERIES
Fuel cells

Perfluoro sulfonic acid polymer dispersion

FORBLUE™ S-SERIES
Various electrolysis and electrodialysis applications



Perfluoro sulfonic acid ion exchange membrane

AGC's Commitment to Reduction of GHG

Net Zero Carbon Target (Fiscal Year 2050)

Mostly achieved the CO_2 reduction target "of reducing annual CO_2 emissions by 6 times by 2020 through energy-saving and energy-creating products" set in 2014.

Will continue to focus on GHG reduction through products and technology.

Aiming to achieve net zero carbon in 2050

Net zero carbon emissions in 2050 (scope 1+2)

FY2020 — FY2030 — FY2050

FY2030 milestone (from the 2019 figure)

GHG emissions (scope 1+2 emissions) 30% reduction

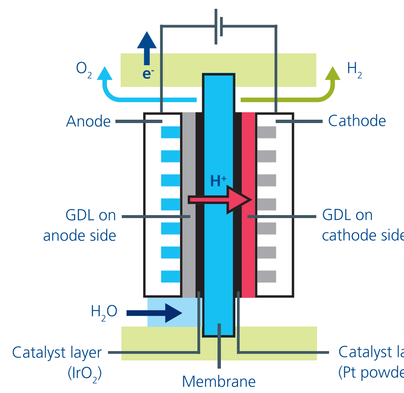
GHG emissions per unit of sale (scope 1+2 emissions / net sales) 50% reduction

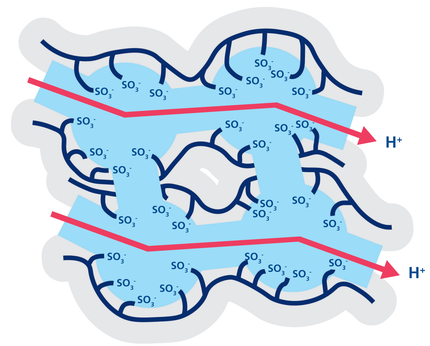
Development of ion-exchange membrane for PEM Water Electrolysis (PEMWE)

FORBLUE™ S-SERIES

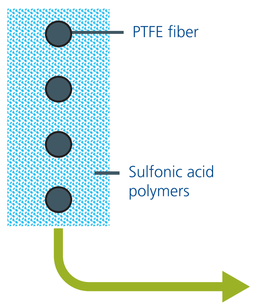
Perfluoro sulfonic acid ion exchange membranes

Improvement of energy efficiency is led by high H+ conductivity or low electric resistance of the membrane





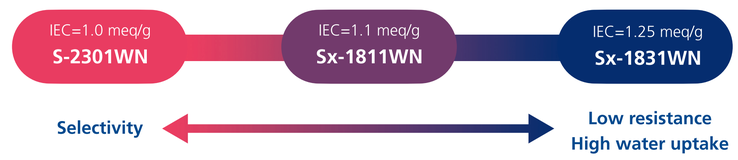
S-SERIES Basic Membrane Type



Versatile fluorine-based ion exchange membrane with a wide range of ion exchange capacities

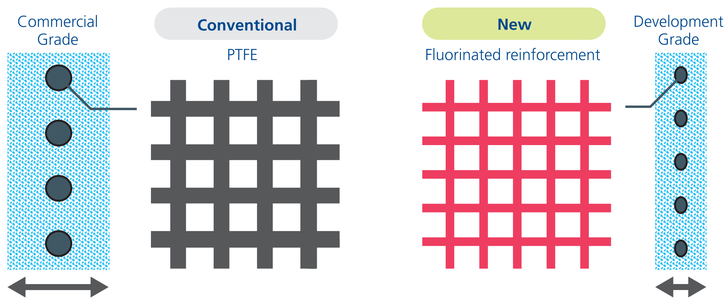
- Fluorine ion exchange membrane
- Wide range of ion exchange capacities
- High mechanical strength, chemical resistance

IEC: Ion Exchange Capacity (meq/g) = 1 / Equivalent Weight x 1000

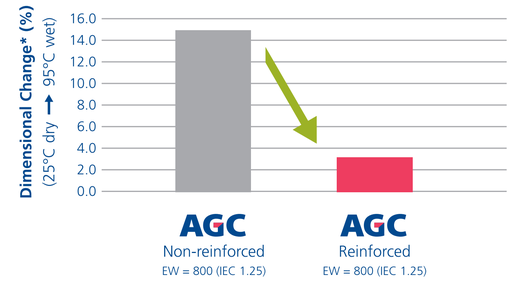


In-plane Dimensional Change

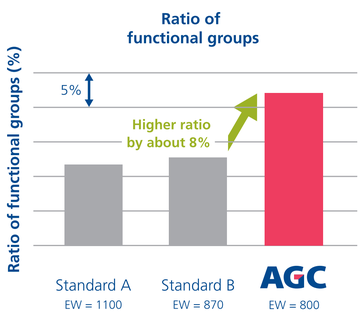
High water uptake sacrifices dimensional stability → Reinforcement

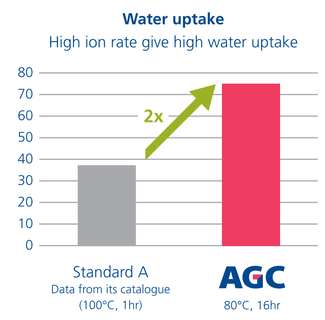


Effect of Reinforcement



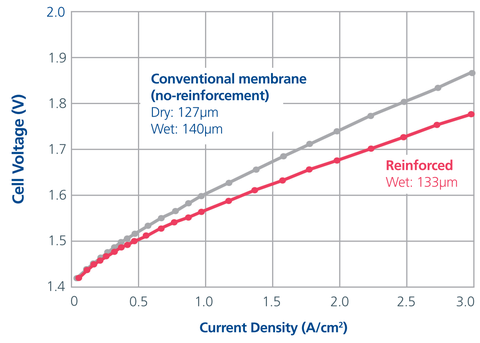
Comparison with Conventional Membrane





i-V Curve

The new membrane with a high ratio of the functional group enables lower voltage.



Conclusion

- Higher IEC makes larger ion channels, referred to as water uptake
- Additionally, new reinforcement improved dimensional stability even with high water uptake
- New membranes have been successfully developed, optimizing IEC, thickness, and reinforcement
- The optimization reduced cell voltage compared to conventional membranes

Scan for more information