Next Generation FORBLUE™ S-SERIES

Membranes for PEM Water Electrolysis

William Salem, Shintaro Hayabe, Misa Inamoto

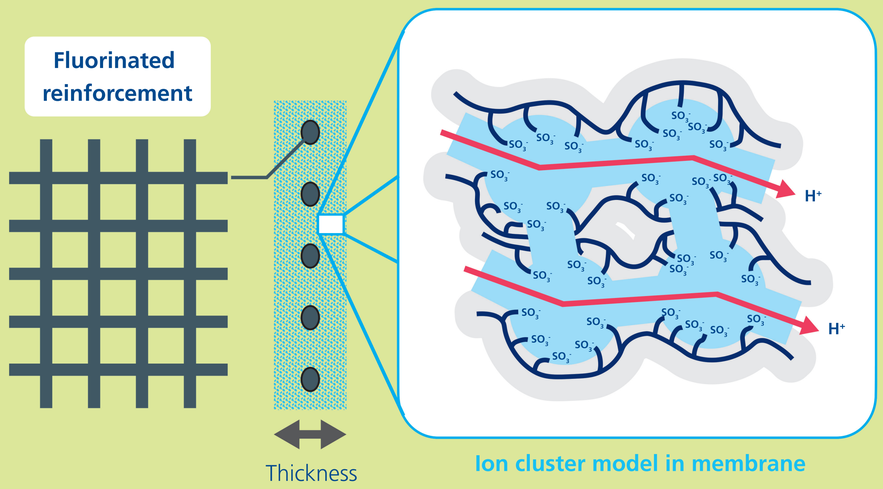
Abstract

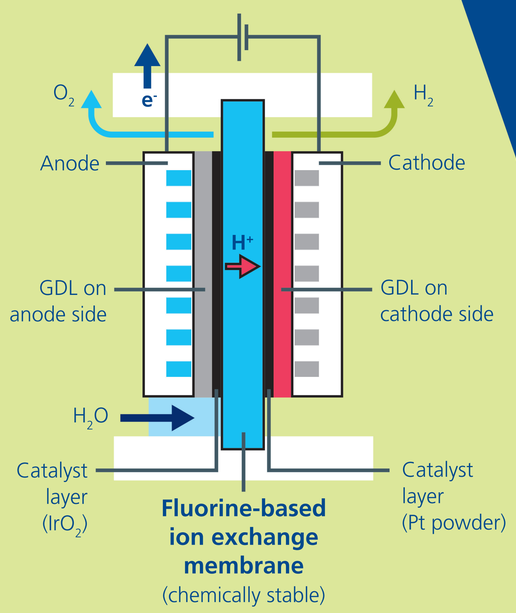
S-SERIES, a FORBLUE™ member, is a perfluorinated ion exchange membrane used for polymer electrolyte membrane water electrolysis and various other electrolysis and electrodialysis applications.

Recently, AGC has developed a new generation of S-SERIES membranes with smaller thicknesses, improved reinforcement, and higher ion-exchange capacity (IEC).

The membrane showed lower electric resistance, more stable dimensional change, and lower gas crossover compared to standard and competitive membranes.

AGC Membrane Design





History of AGC's FORBLUE Business

FORBLUE™ SELEMION

Salt production / Desalting / Water production / Acid recovery

Hydrocarbon ion exchange membrane

1933
Start of caustic soda production (chemical process)

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

FORBLUE™ FLEMION

Caustic soda production / Caustic potash manufacturing

Perfluoro ion exchange membrane

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 as a by-product

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

FORBLUE™ sunsep

Dehumidification / Humidification of gas

Perfluoro sulfonic acid tube

1990
sunsep product line is launched for dehumidification of gas passing through the tube

2001
Discontinued electrolyzer business and focus on IEM business

FORBLUE™ i-SERIES

Fuel cells

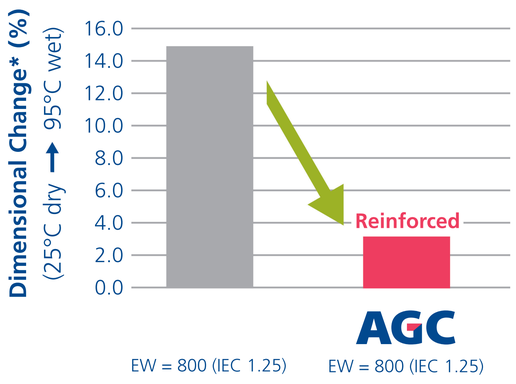
Perfluoro sulfonic acid polymer dispersion

FORBLUE™ S-SERIES

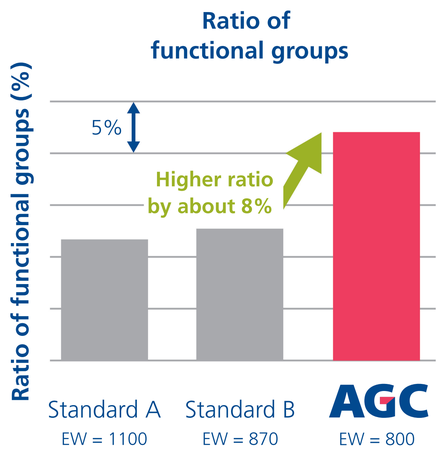
Various electrolysis and electrodialysis applications

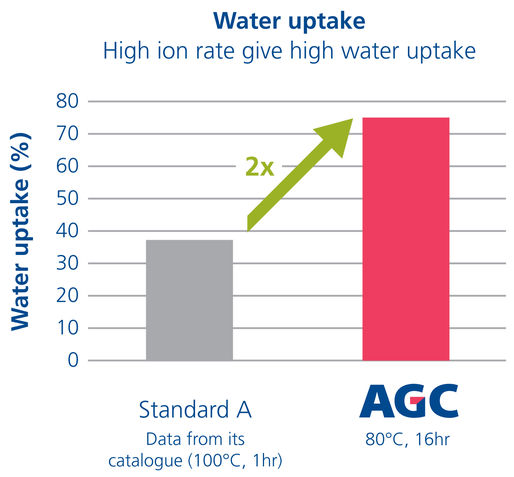
Perfluoro sulfonic acid exchange membrane

Effect of Reinforcement

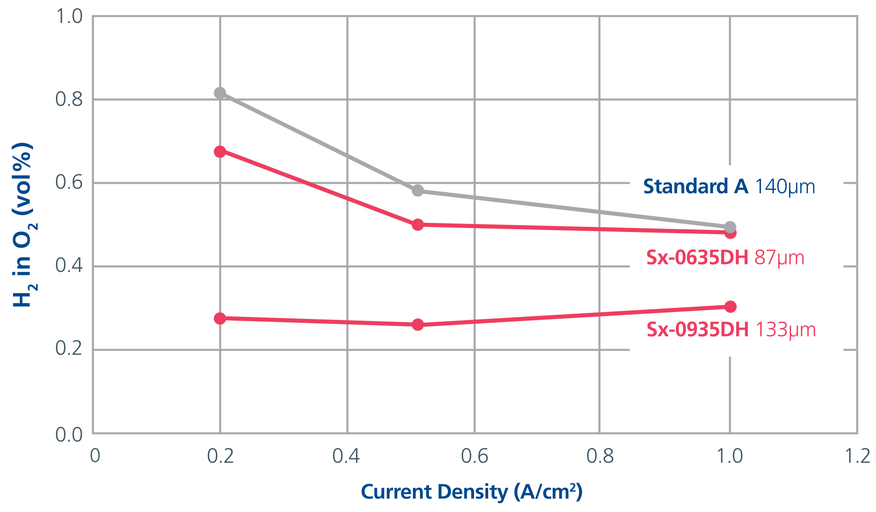


Comparison with Conventional Membrane



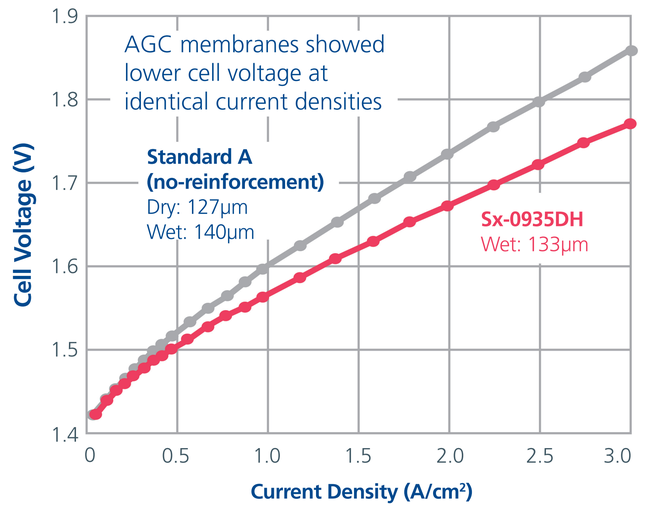


Gas Crossover Comparison



Conditions: Temperature 80°C; ambient condition.

i-V Curve



Conditions: Anode: $1mg_{-k}/cm^2$; Cathode: $0.4mg_{-Pt}/cm^2$; Active area: 25 cm^2; Temperature: 80°C.

AGC Chemicals Company Position in the Hydrogen Economy

With 60 years of experience in ion exchange membranes (IEM), AGC has supported various industries and embraces the opportunity to support the growing hydrogen economy.

Conclusion

- Higher IEC makes larger ion channels, referred to as water uptake, lowering cell voltage.
- Additionally, new reinforcement improved dimensional stability even with higher water uptake.
- Gas crossover can be minimized even with a thinner membrane.
- Newly developed membranes optimize IEC, thickness, and reinforcement.