



Clorosur Technical Seminar
& WCC Safety Workshop

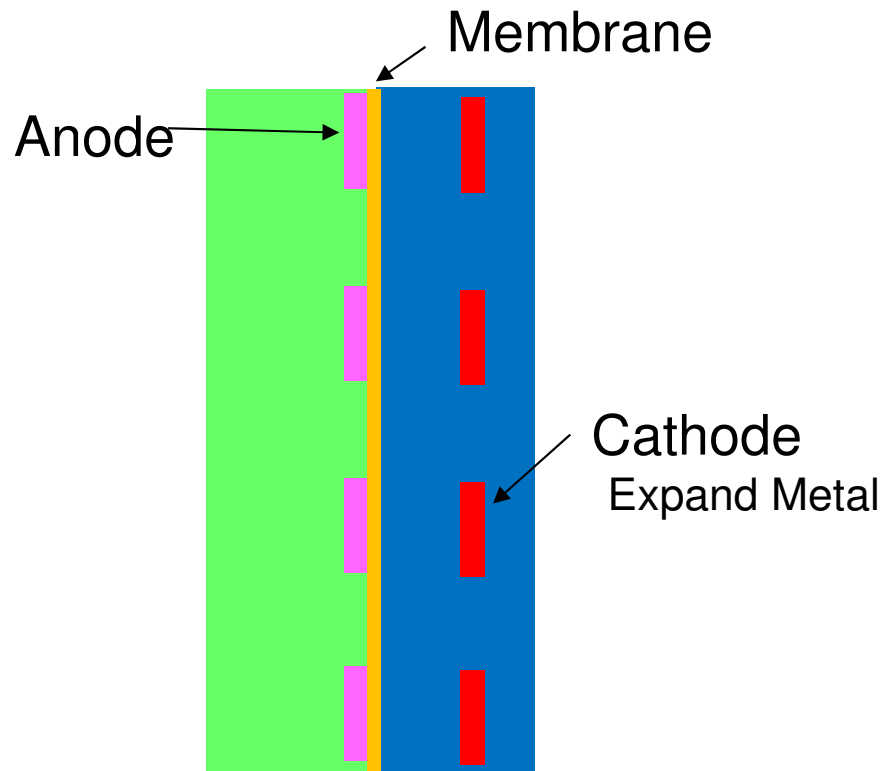
New Flemion Membranes for Zero Gap Configuration

AGC Chemicals
ASAHI GLASS CO., LTD.

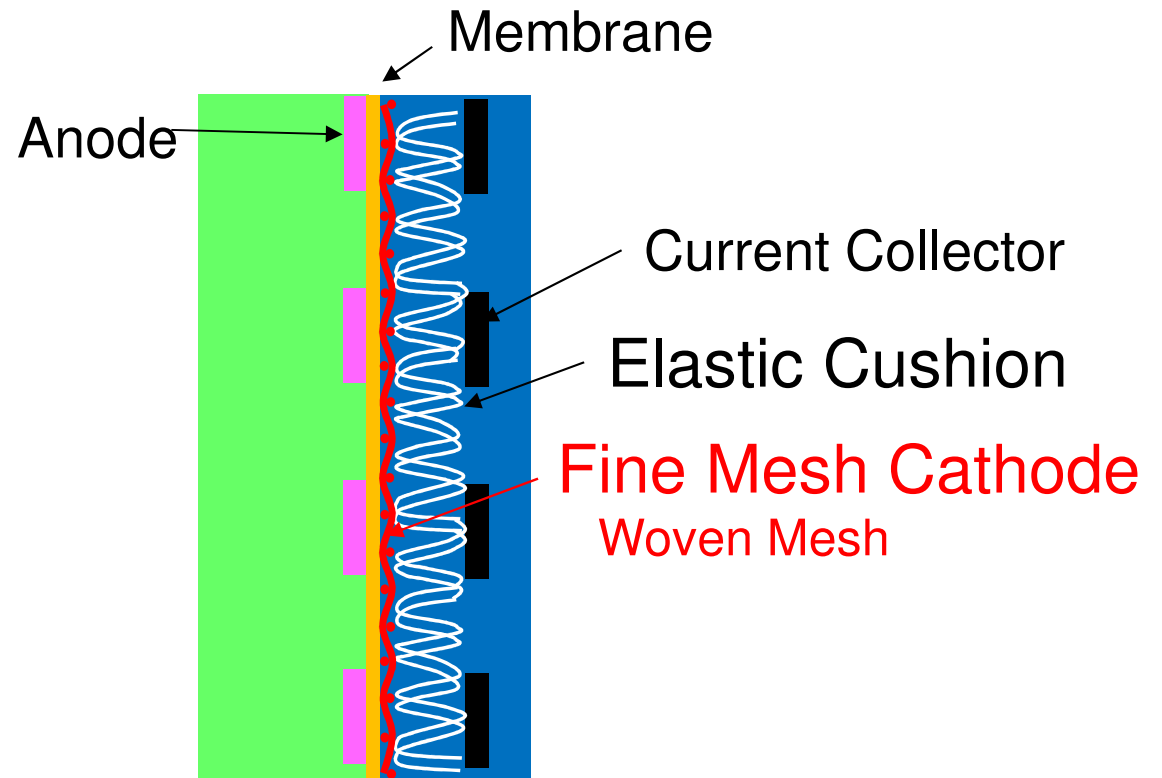


- Influence of Zero Gap on the membrane
- F-8080A : New Type of F-8080 series for Zero Gap
- Next Generation Membrane

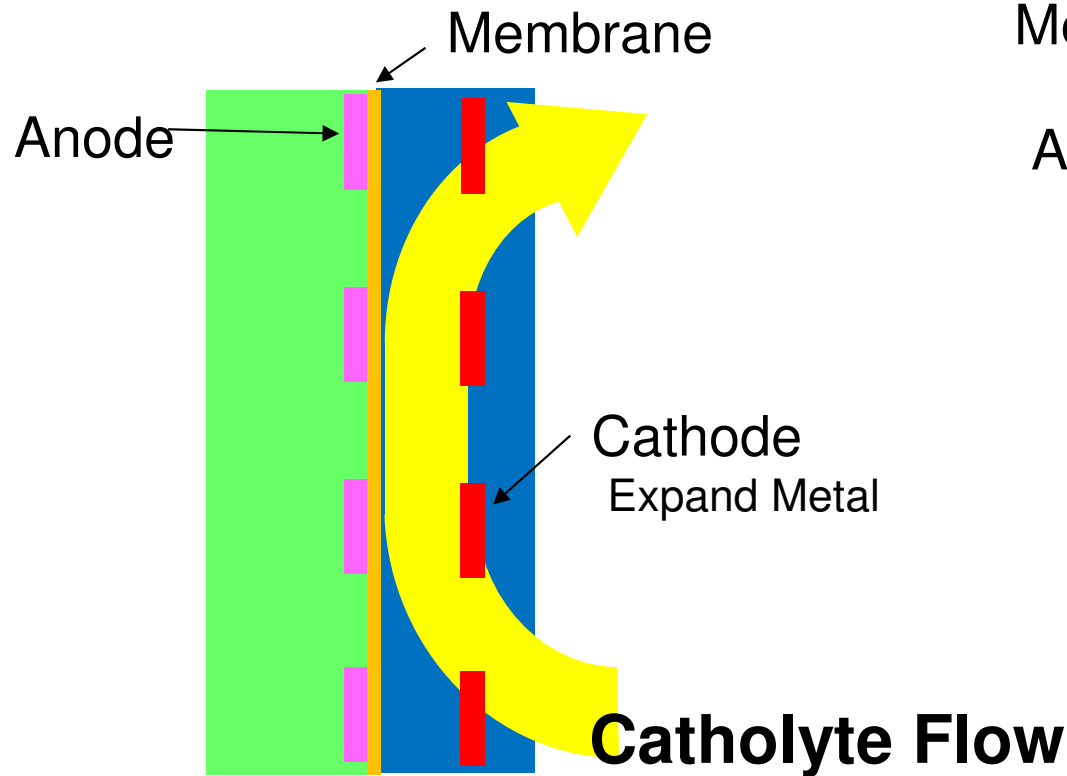
Finite Gap



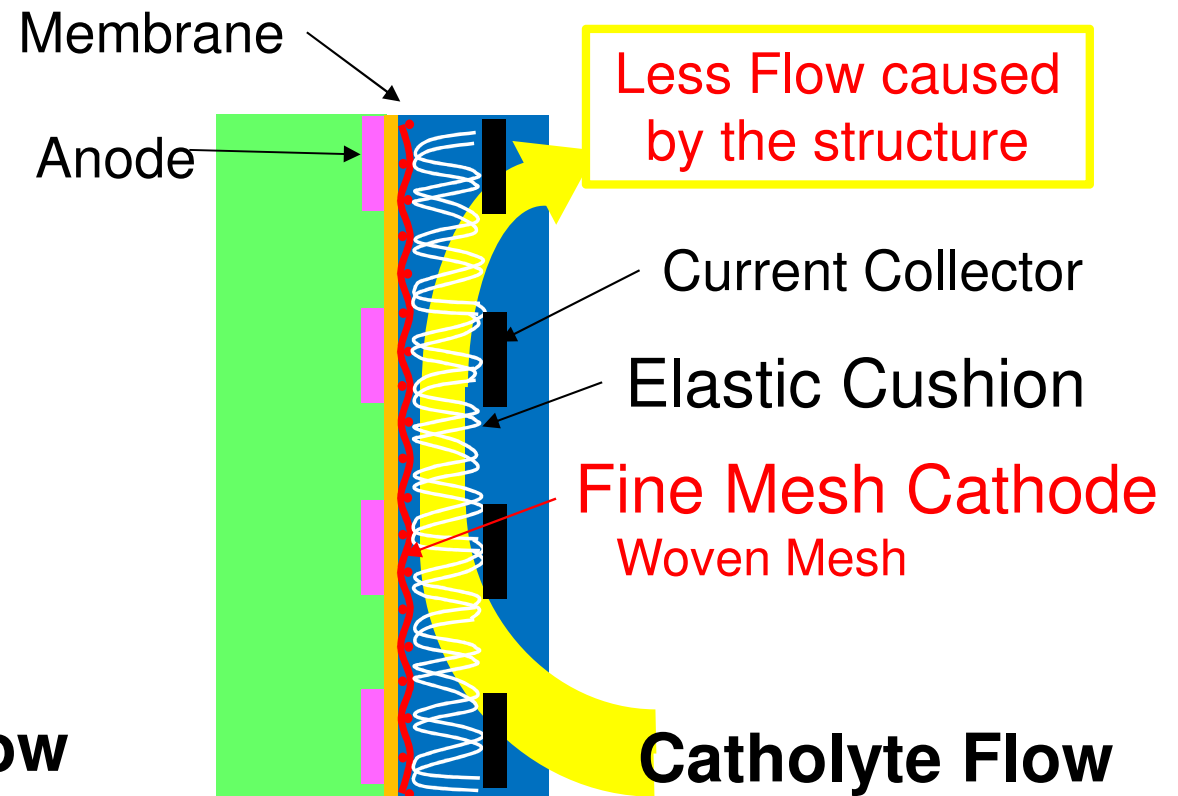
Zero Gap



Finite Gap



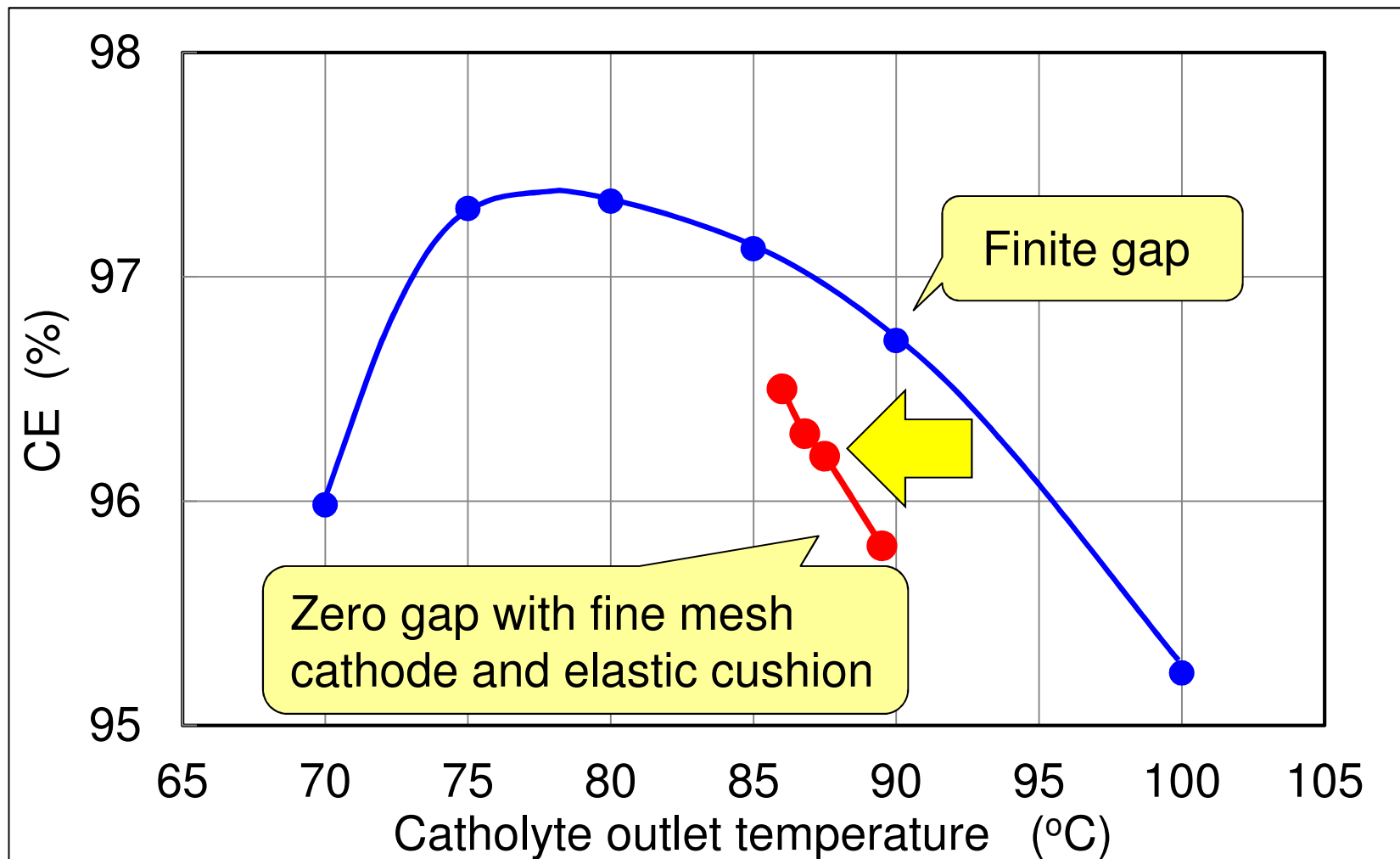
Zero Gap



Less flow of catholyte at membrane surface removes less heat of membrane, which makes membrane higher temperature than catholyte outlet.

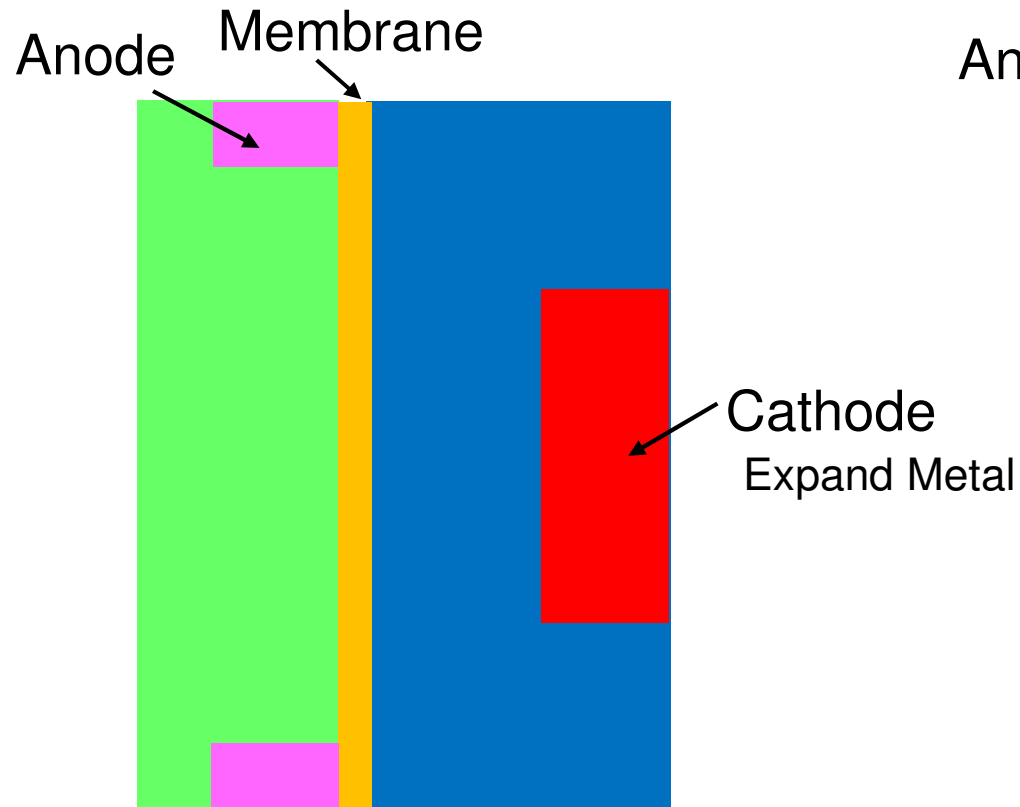
Higher Temperature in Zero Gap

F-8080, 6 kA/m², 32 wt% NaOH, 200 g/l NaCl

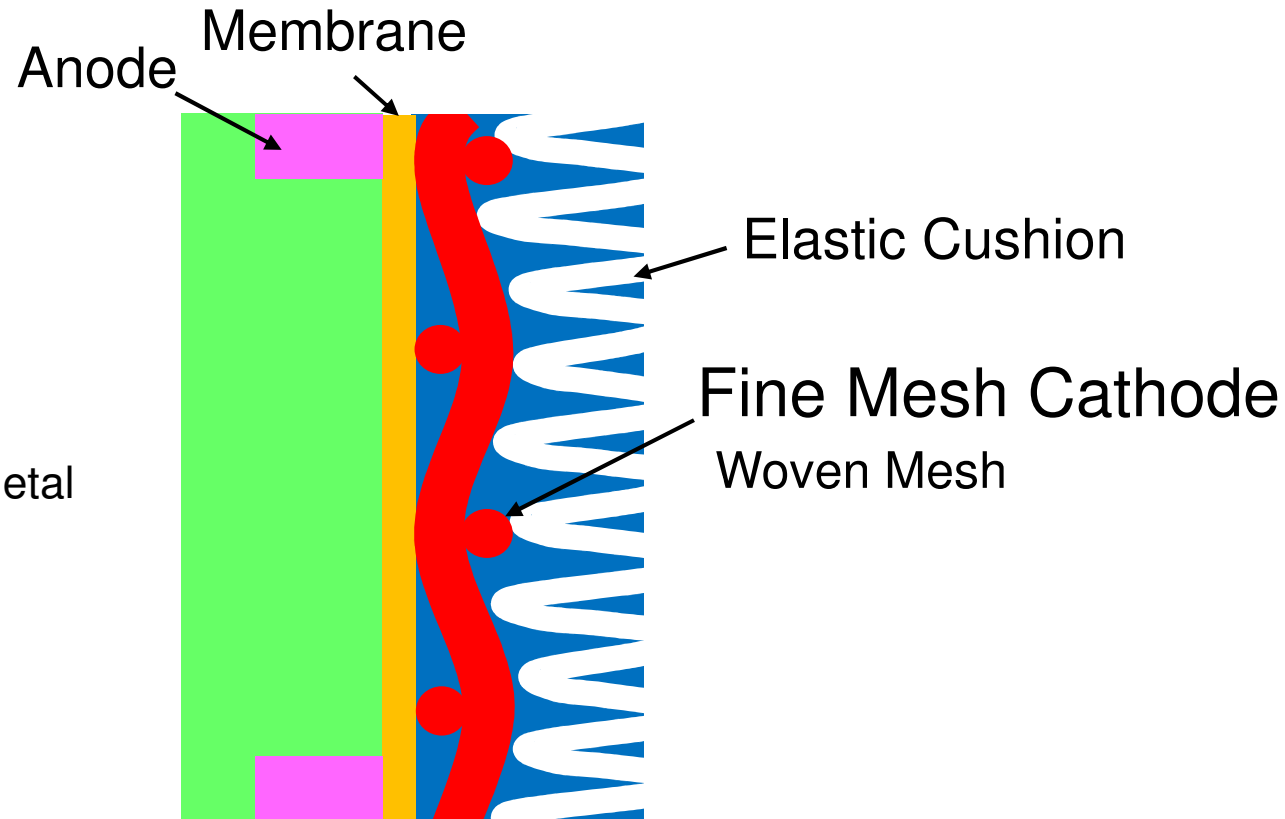


The temperature of the membrane in zero gap is at least 5 °C higher than in finite gap.

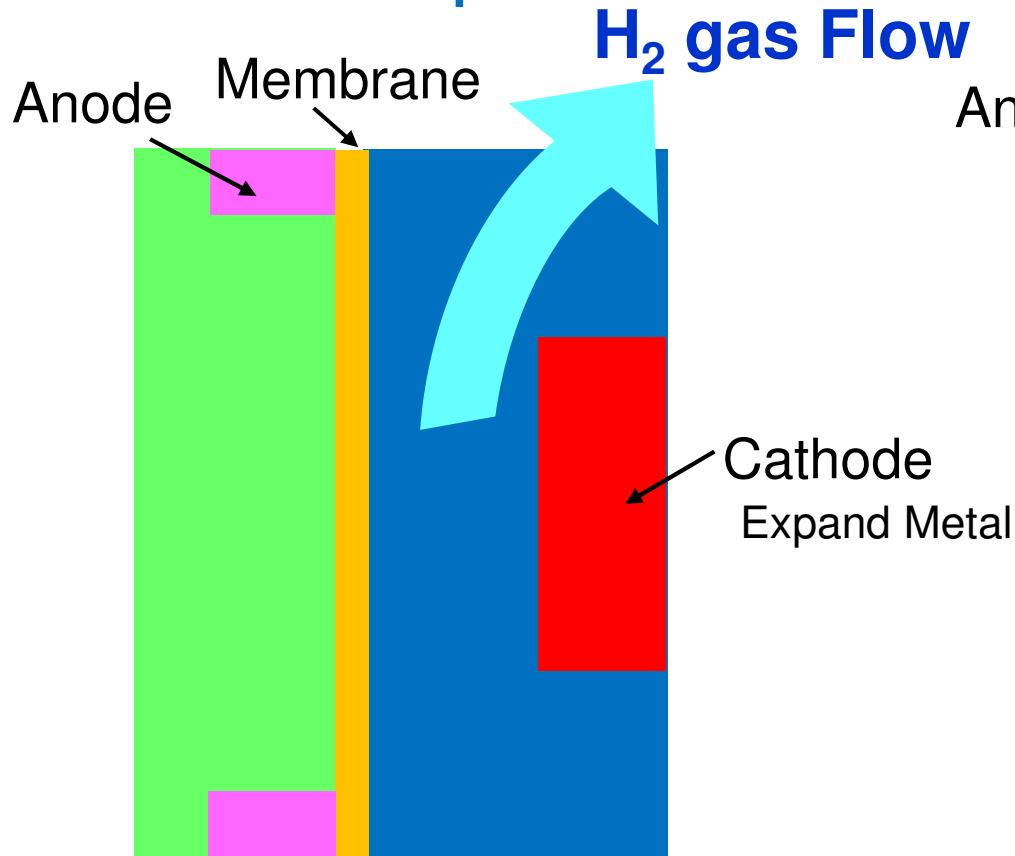
Finite Gap



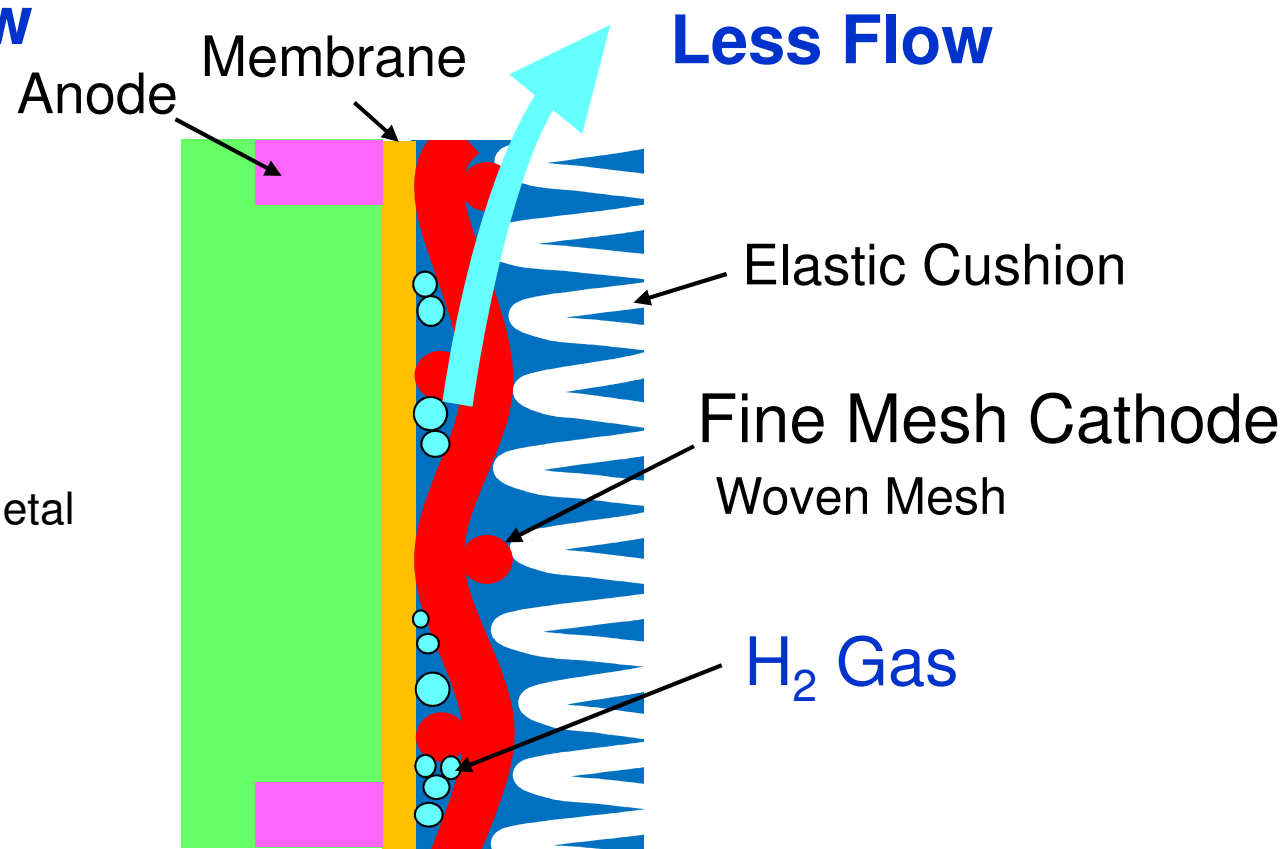
Zero Gap



Finite Gap

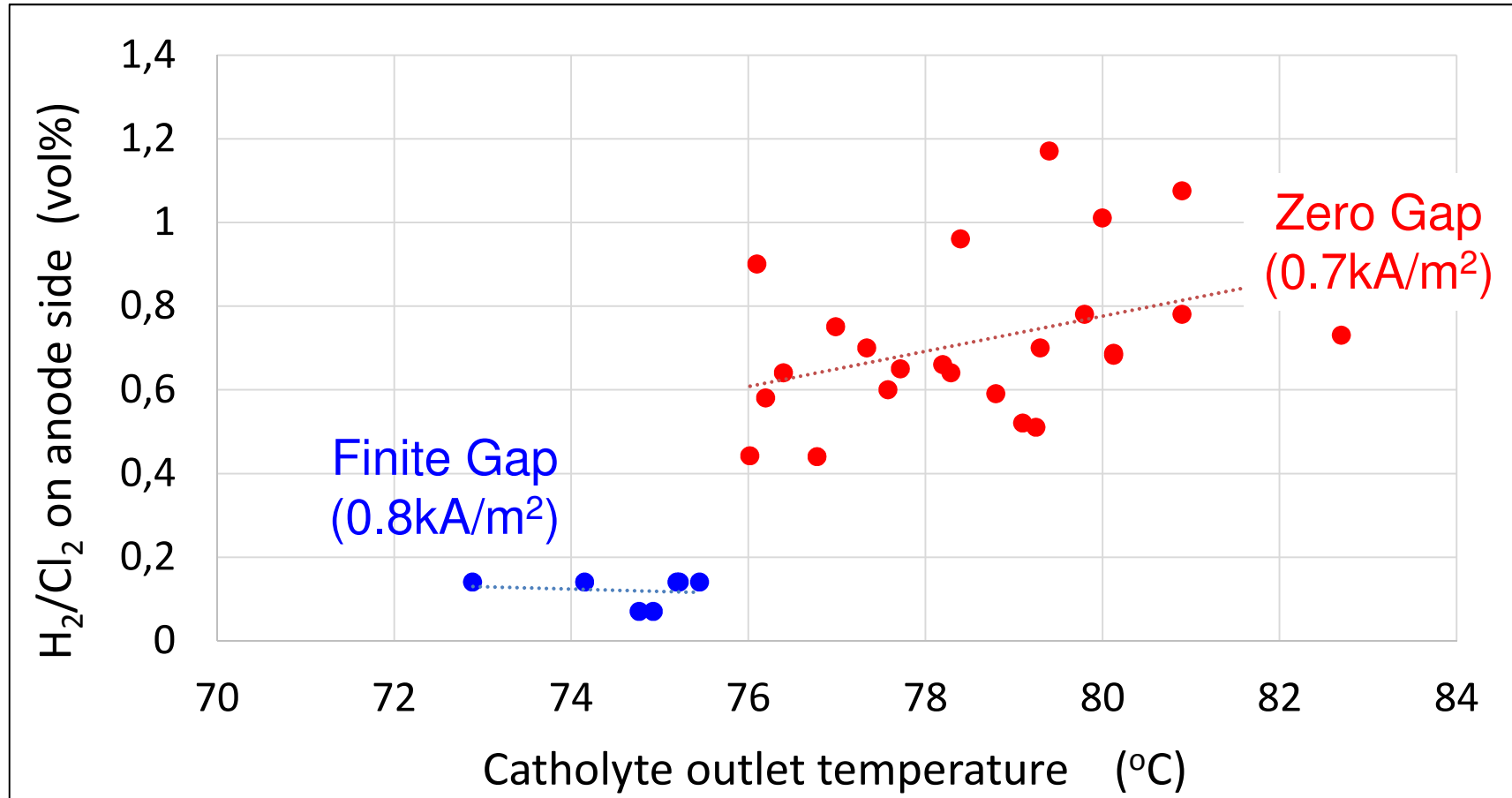


Zero Gap



Less flow makes more H₂ gas bubbles touch the membrane, caused by zero gap structure.

H₂/Cl₂ on anode side at low CD in commercial size electrolyzer

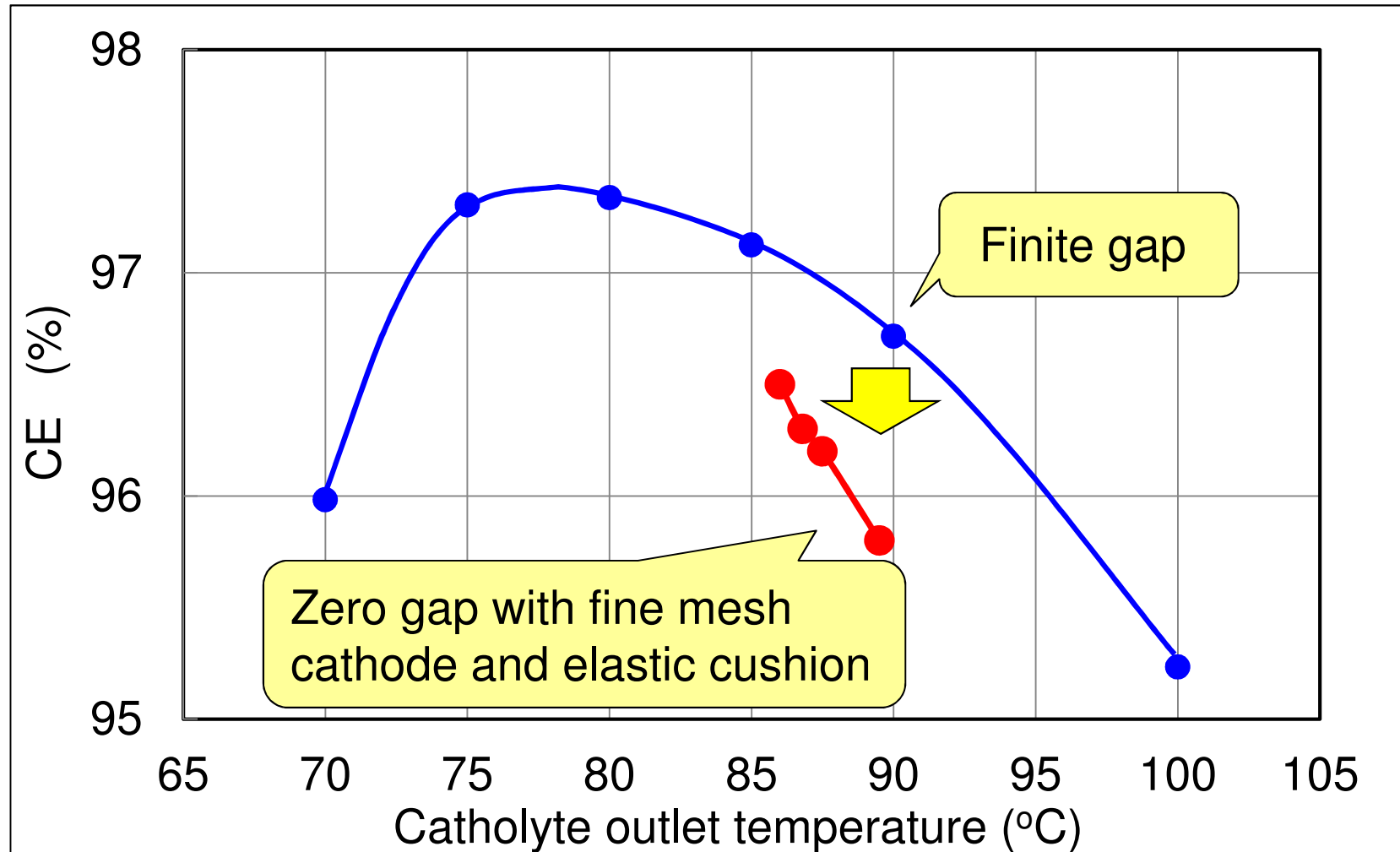


Zero gap shows higher H₂ in Cl₂ than finite gap in same electrolyzer, which indicates more H₂ gas touches to cathode side surface of the membrane.

- Influence of Zero Gap on the membrane
- **F-8080A ; New Type of F-8080 series for Zero Gap**
- Next Generation Membrane

F-8080 : CE Decrease in Zero Gap

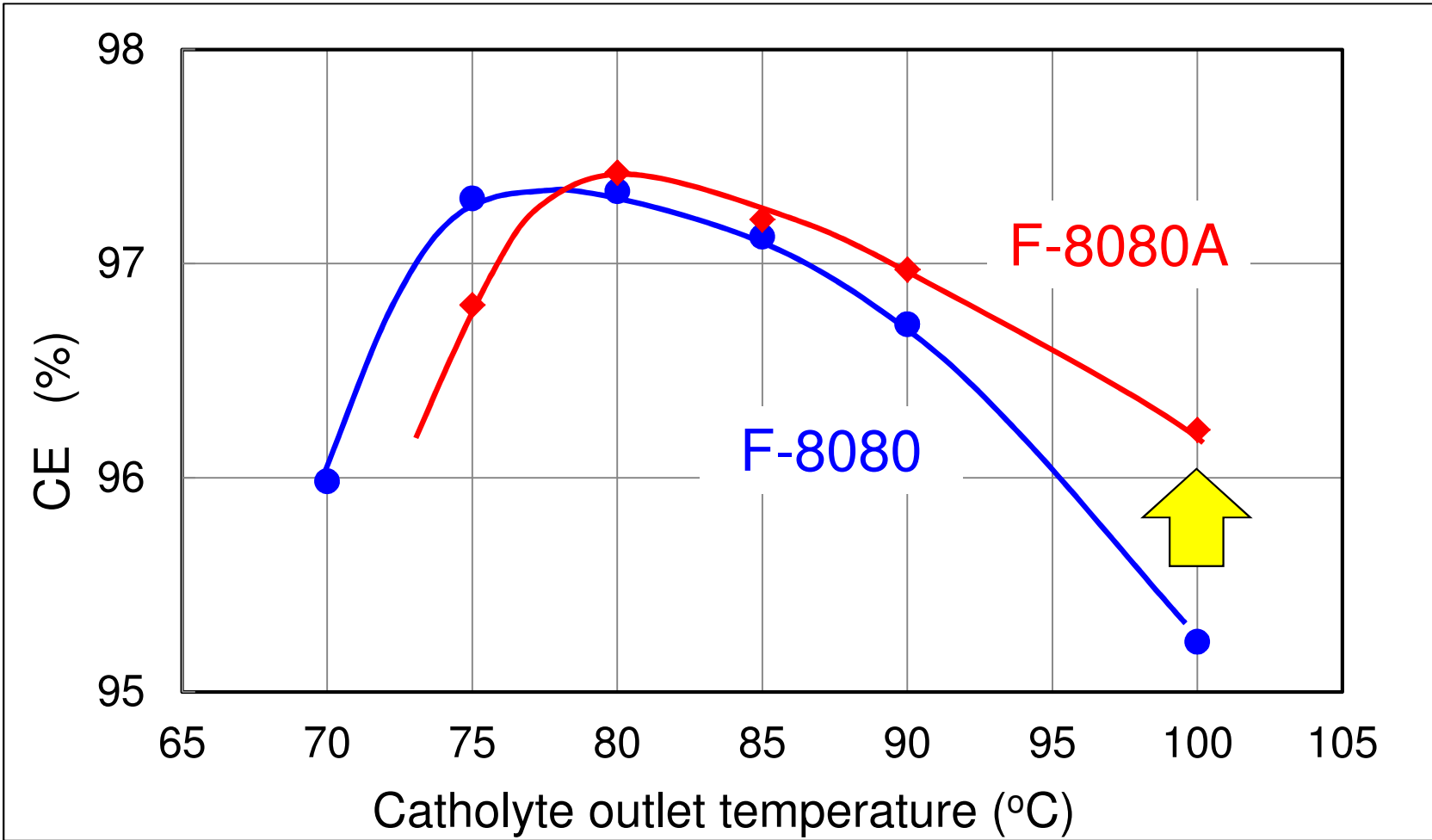
F-8080, 6 kA/m², 32 wt% NaOH, 200 g/l NaCl



F-8080 in zero gap shows 0.5-1% lower CE than in finite gap at high temperature.

Finite gap (Lab cell)

6 kA/m², 32 wt% NaOH, 200 g/l NaCl

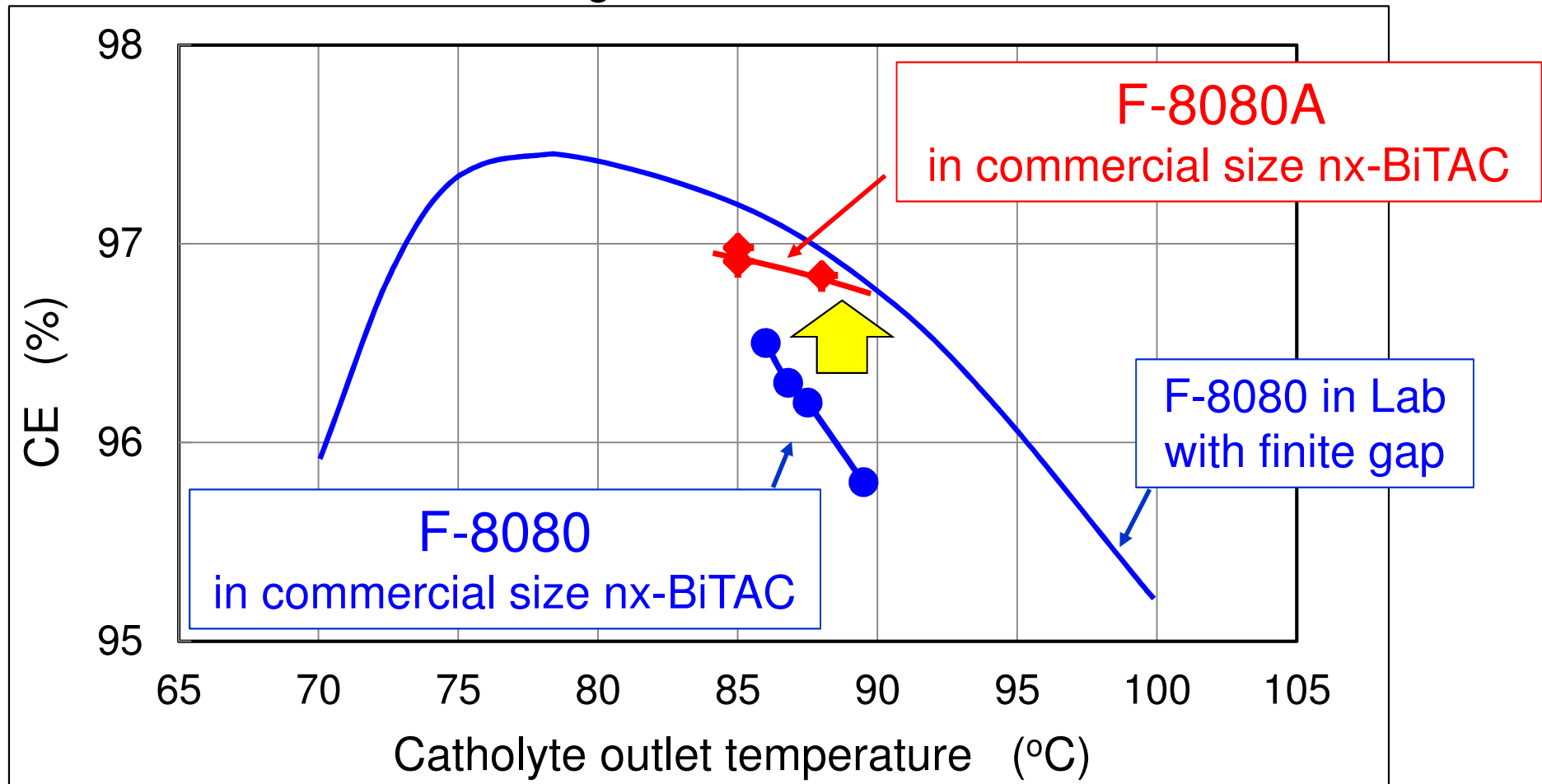


F-8080A shows more than 96 % CE even at 100 °C.

F-8080A : Higher CE in commercial size nx-BiTAC

Zero gap (Commercial size nx-BiTAC)

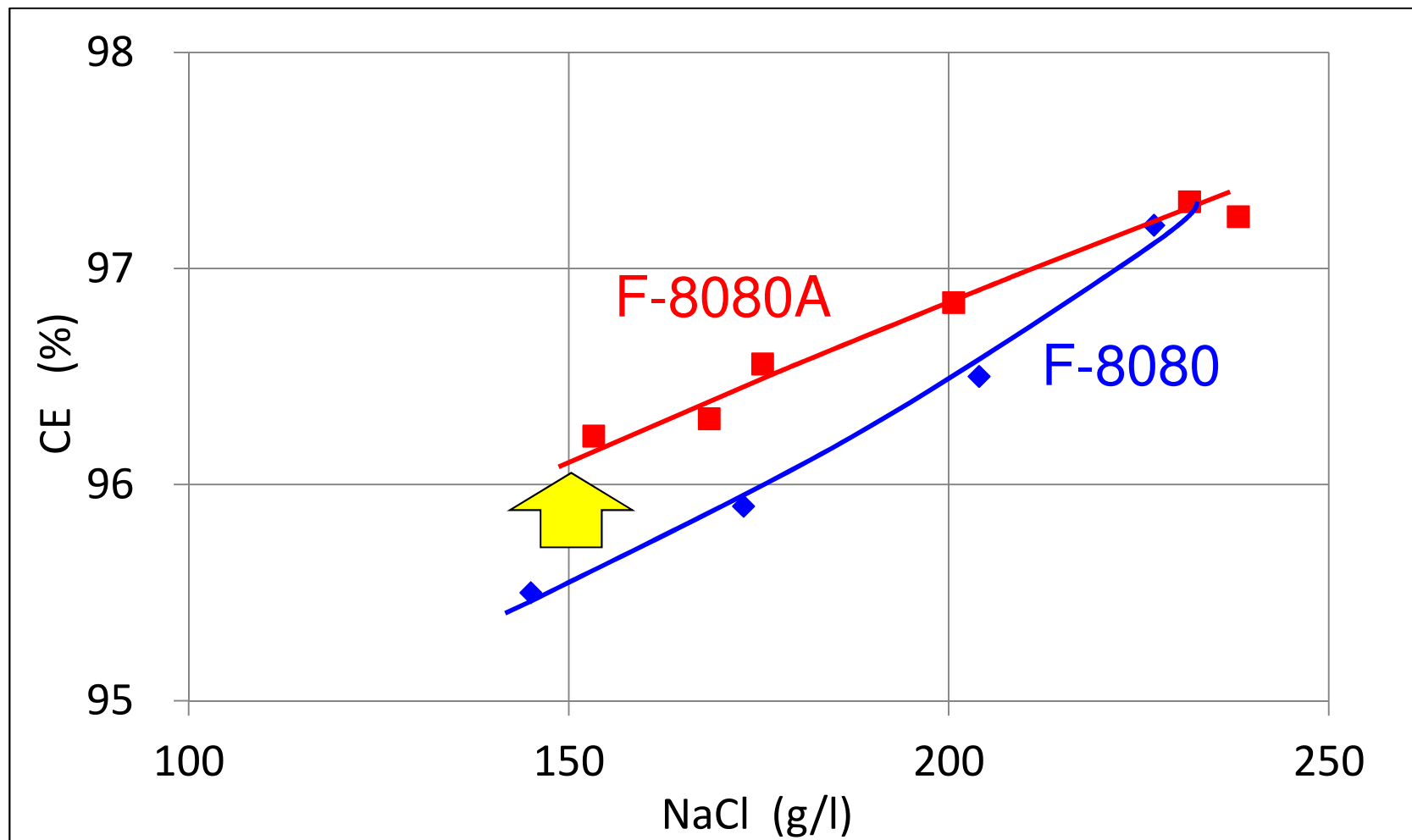
6kA/m², 32wt% NaOH, 200g/l NaCl



F-8080A in commercial nx-BiTAC with zero gap shows high enough CE at high temperature.

F-8080A : Higher CE in Hydrated Condition

Lab cell, 6 kA/m², 90 °C, 32 wt% NaOH



F-8080A shows higher CE in weak brine.

1. Higher stability for zero gap

- Especially, higher CE at high temperature

2. Higher CE against hydrated state

- higher CE in weak brine

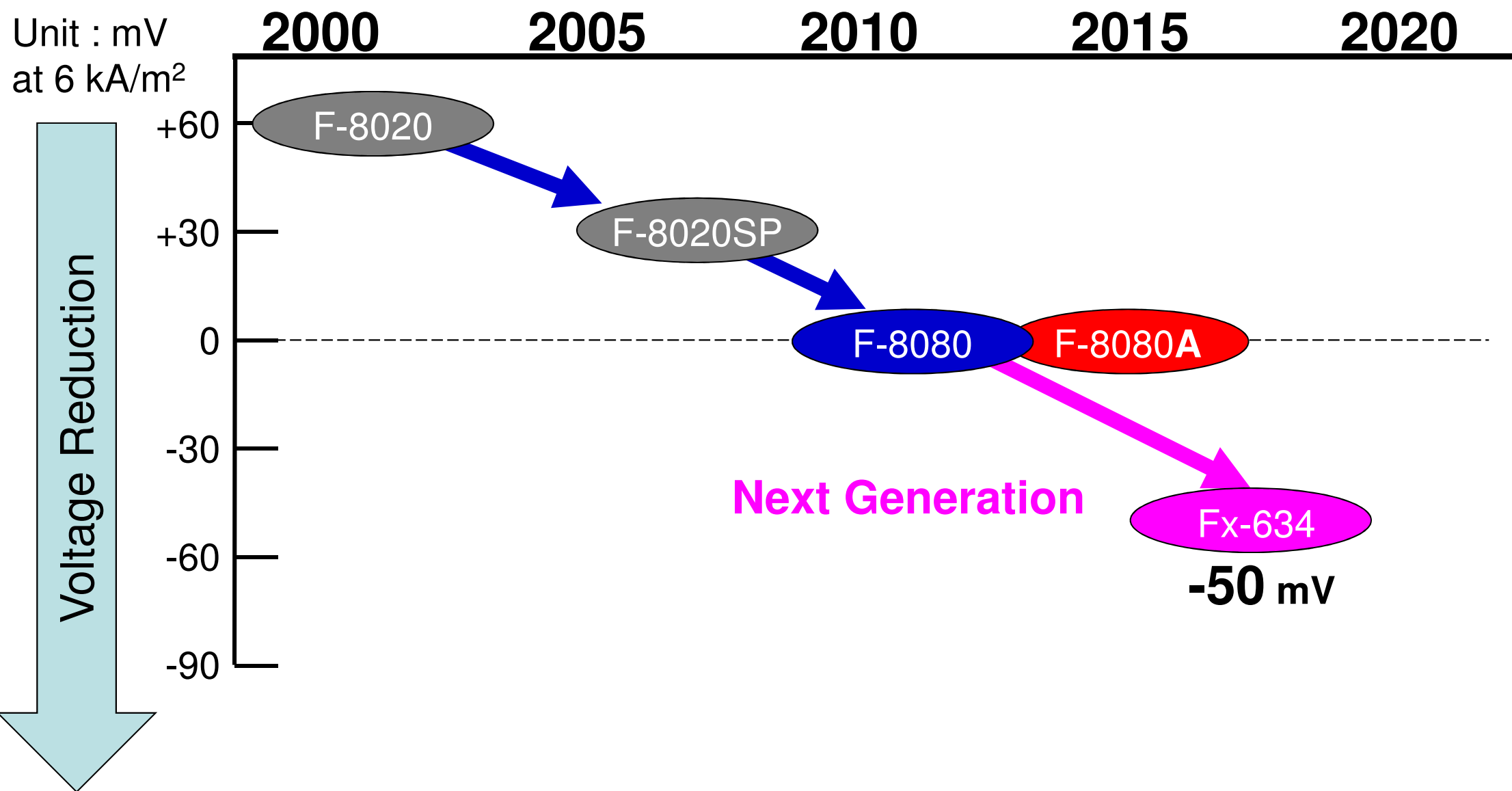
3. Same voltage and durability as F-8080

- Low voltage and high durability
- Fine adjustment of F-8080 which has proven reliability

- Influence of Zero Gap on the membrane
- F-8080A : New Type of F-8080 series for Zero Gap
- **Next Generation Membrane**
 - Lowest Voltage
 - Higher CE in Wider Range
 - Higher Durability against I/Ba

Lowest Voltage

Unit : mV
at 6 kA/m²

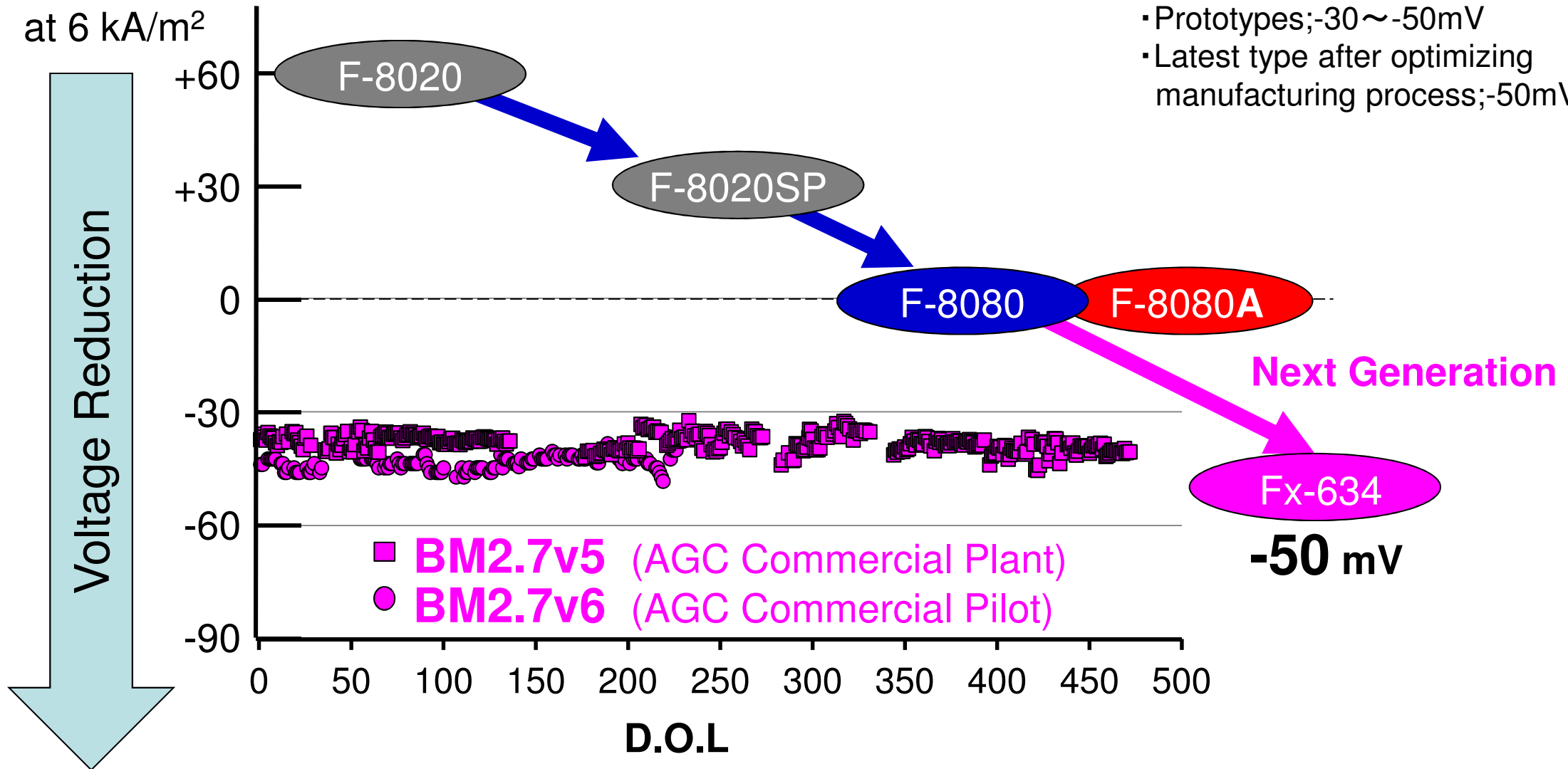


Stability of Lowest Voltage

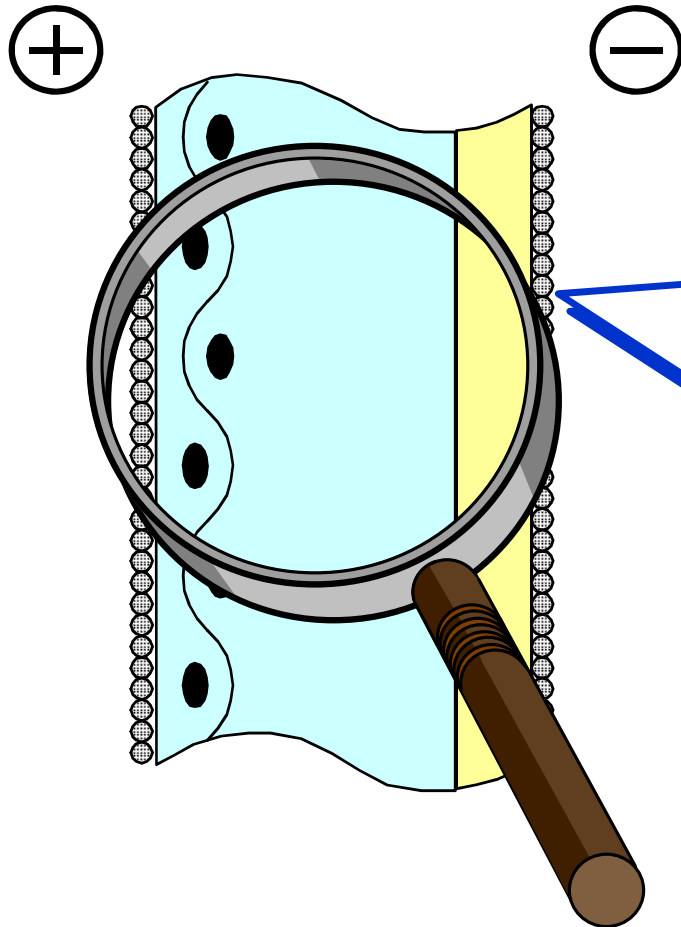
Unit : mV
at 6 kA/m²

Note;

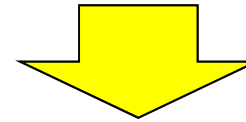
- Prototypes; -30 ~ -50 mV
- Latest type after optimizing manufacturing process; -50 mV



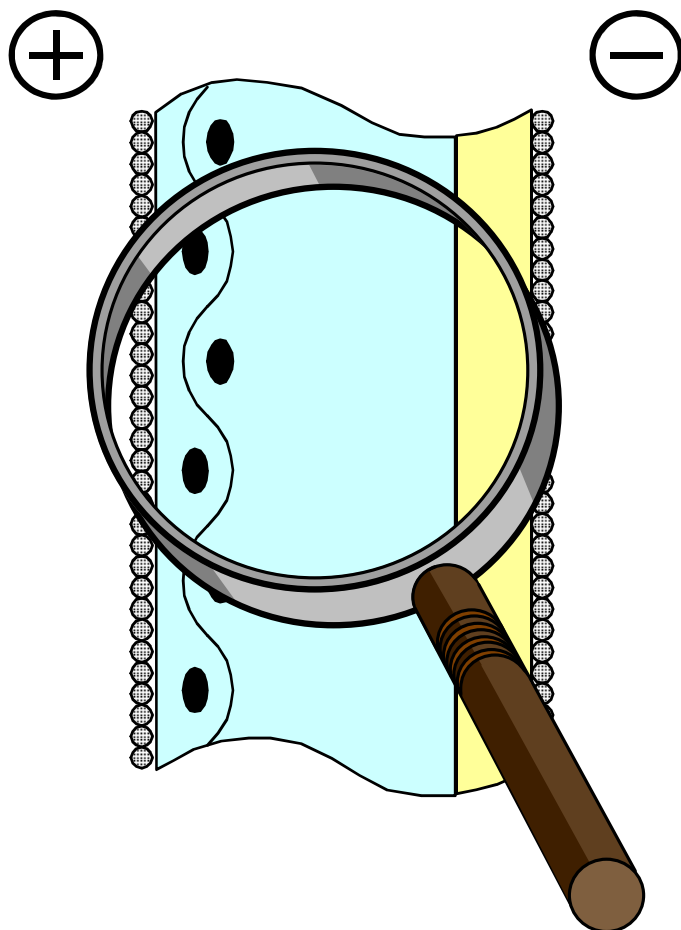
Prototypes of next generation membrane keep stable low voltage in AGC commercial electrolyzers for over one year.



What is new?



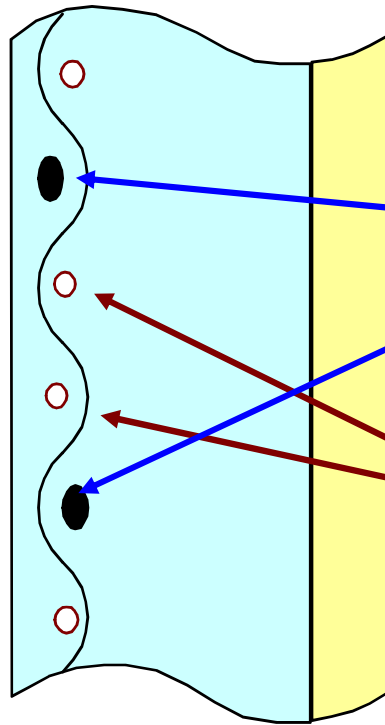
Three new technologies were optimally combined



Advantages	Key Technologies
Voltage Reduction	Fiber Arrangement
Higher CE in Wider Range	Fine Ion Channel
Higher Durability against I/Ba	Uniform Ion Channel

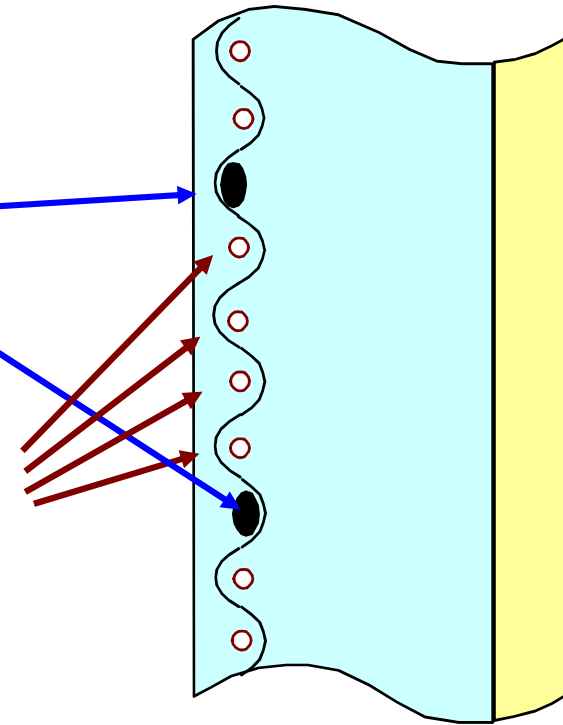
Conventional Cloth

F-8080/F-8080A



Optimized Cloth

Next generation



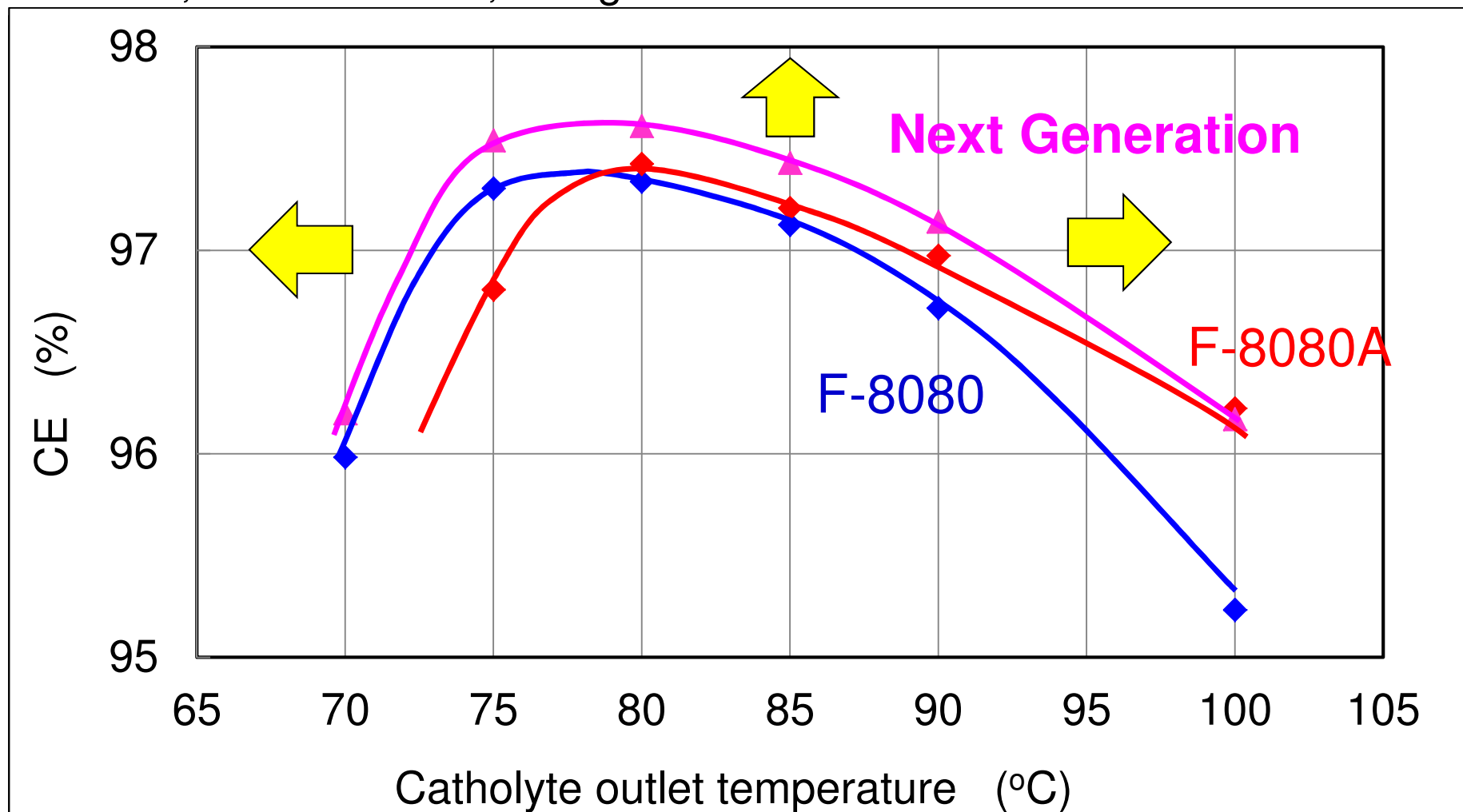
PTFE
Fiber

Sacrificial Fiber

Making use of optimized fiber arrangement, this makes next generation membrane shows lowest voltage.

Higher CE in Wider Temperature Range

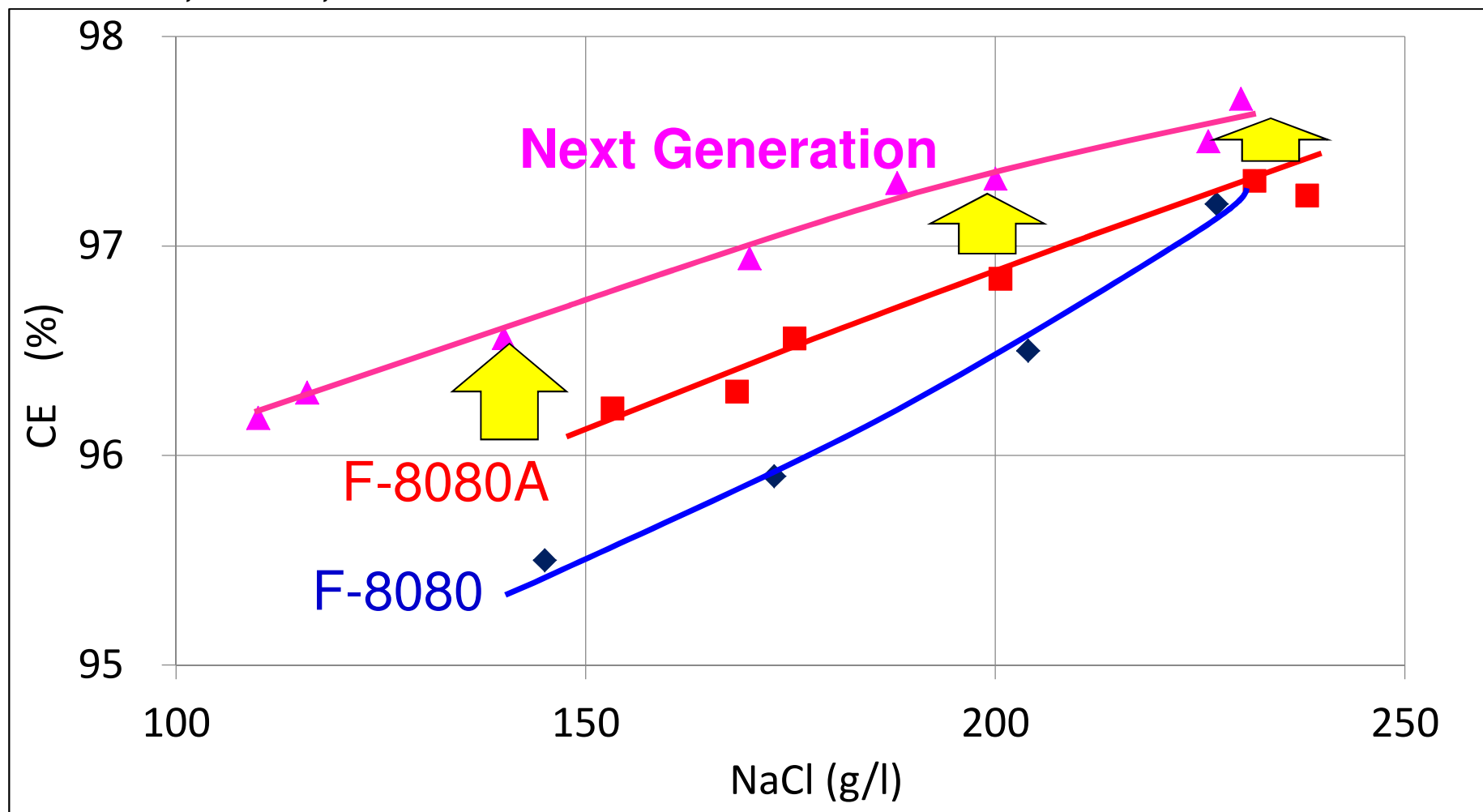
6 kA/m², 32 wt% NaOH, 200 g/l NaCl



Next generation membrane shows higher CE not only at high temperature but also at low temperature.

Higher CE in Weak Brine

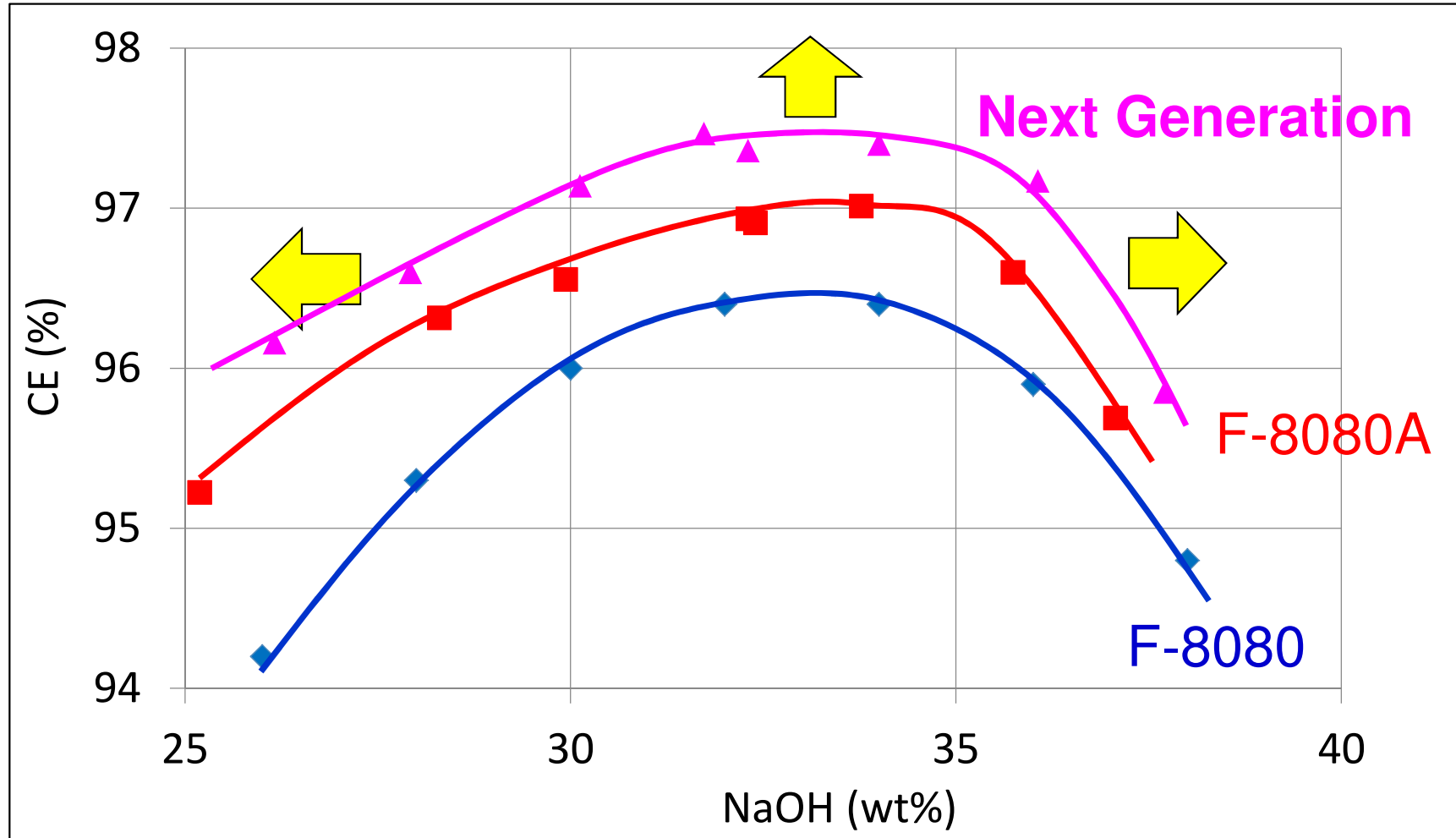
6 kA/m², 90 °C, 32 wt% NaOH



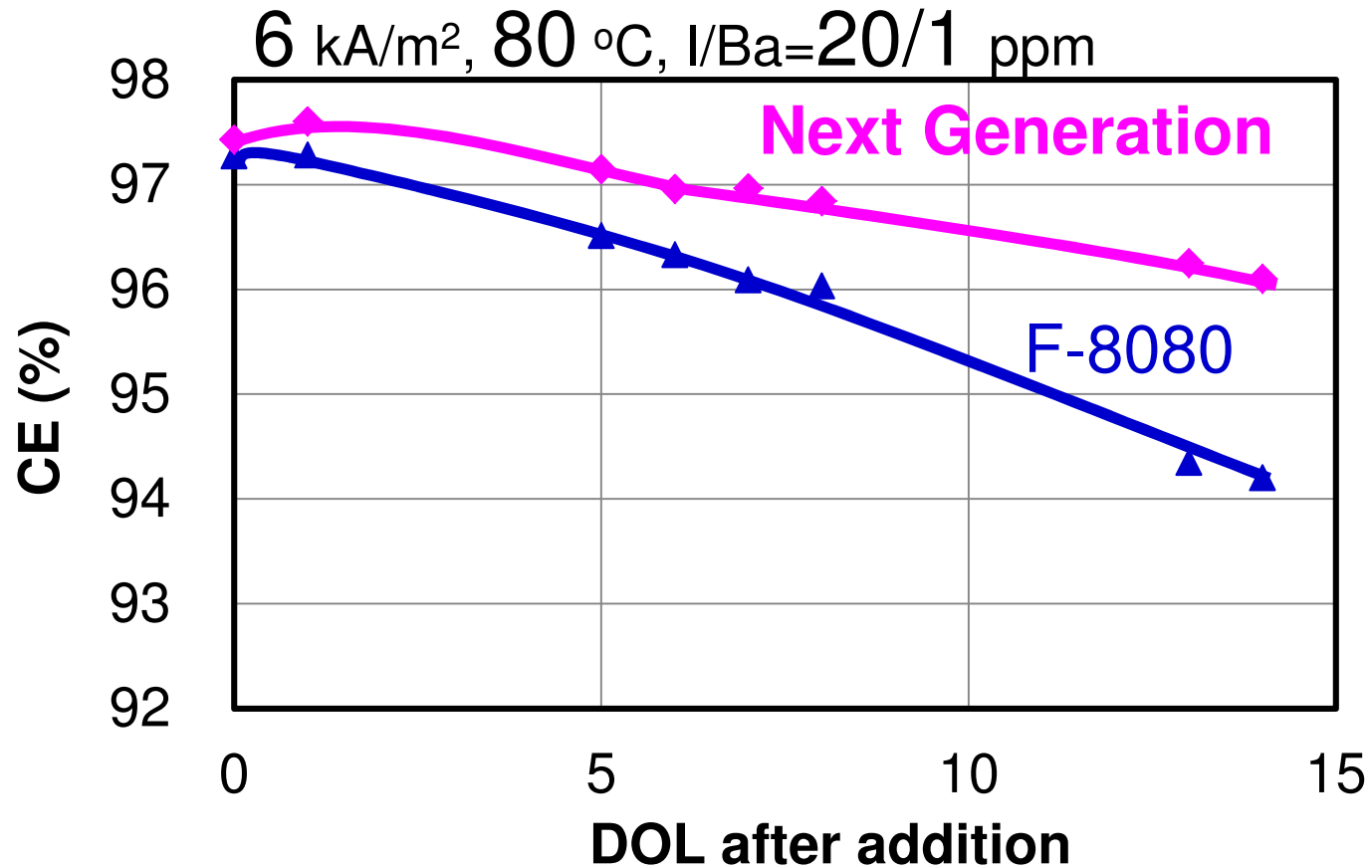
Next generation membrane shows higher CE in weak brine. It is suitable for electrolyzers which have less inner circulation of brine.

Higher CE in Wider Range of Caustic Strength

6 kA/m², 90 °C, 200 g/l NaCl



Next generation shows higher CE in weak and strong caustic.

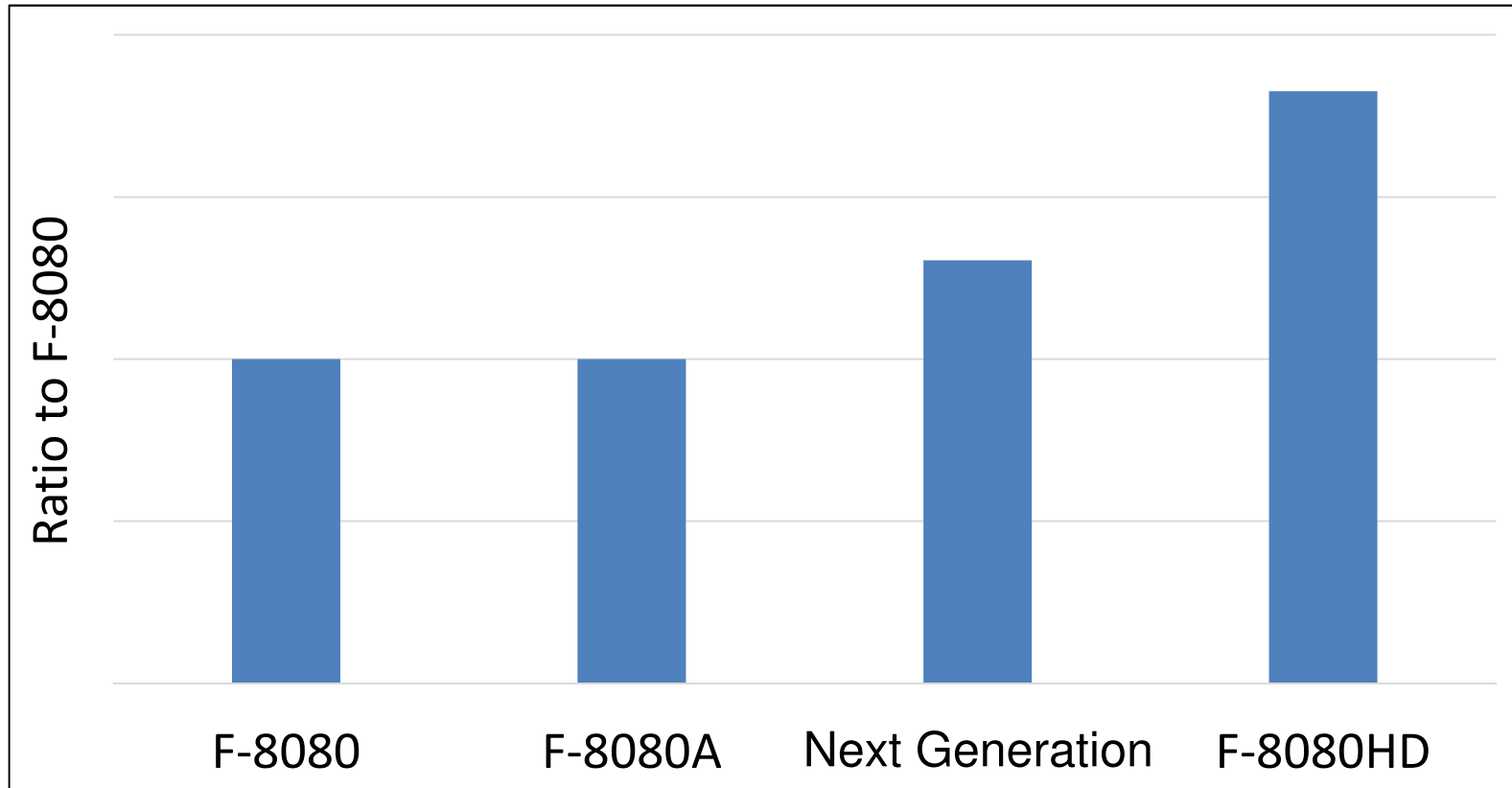


Next generation membrane has higher durability against I/Ba.

Note : Same durability against Ca as F-8080

Furthermore!

Total number of frequent load tensile test until membrane breaking
(Sum of the value to various direction. Load : 60 % of tensile strength)



Next generation membrane is more robust than F-8080 and F-8080A.

1. Lowest voltage

- **50 mV lower voltage** than F-8080 and F-8080A
- Optimized fiber arrangement

2. Higher CE in both hydrated and dehydrated state

- Suitable for zero gap and finite gap
- Suitable for electorolyzer which has less inner circulation of brine

3. Higher durability against I/Ba

4. Better robustness

Large quantity of Fx-634 will be delivered from 2Q 2017.

- **Influence of Zero Gap on the membrane**
 - **Higher temperature** due to less heat removal
- **F-8080A : New Type of F-8080 series for Zero Gap**
 - Advanced F-8080 for higher temperature and weak brine, **for hydrated state**.
 - Fine adjustment of F-8080 which has **proven reliability**.
- **Next Generation Membrane : Fx-634**
 - **50 mV lower voltage** than F-8080/F-8080A
 - **Higher CE in both more hydrated and more dehydrated state**
 - Durability against I/Ba and better robustness

Information of CTCN

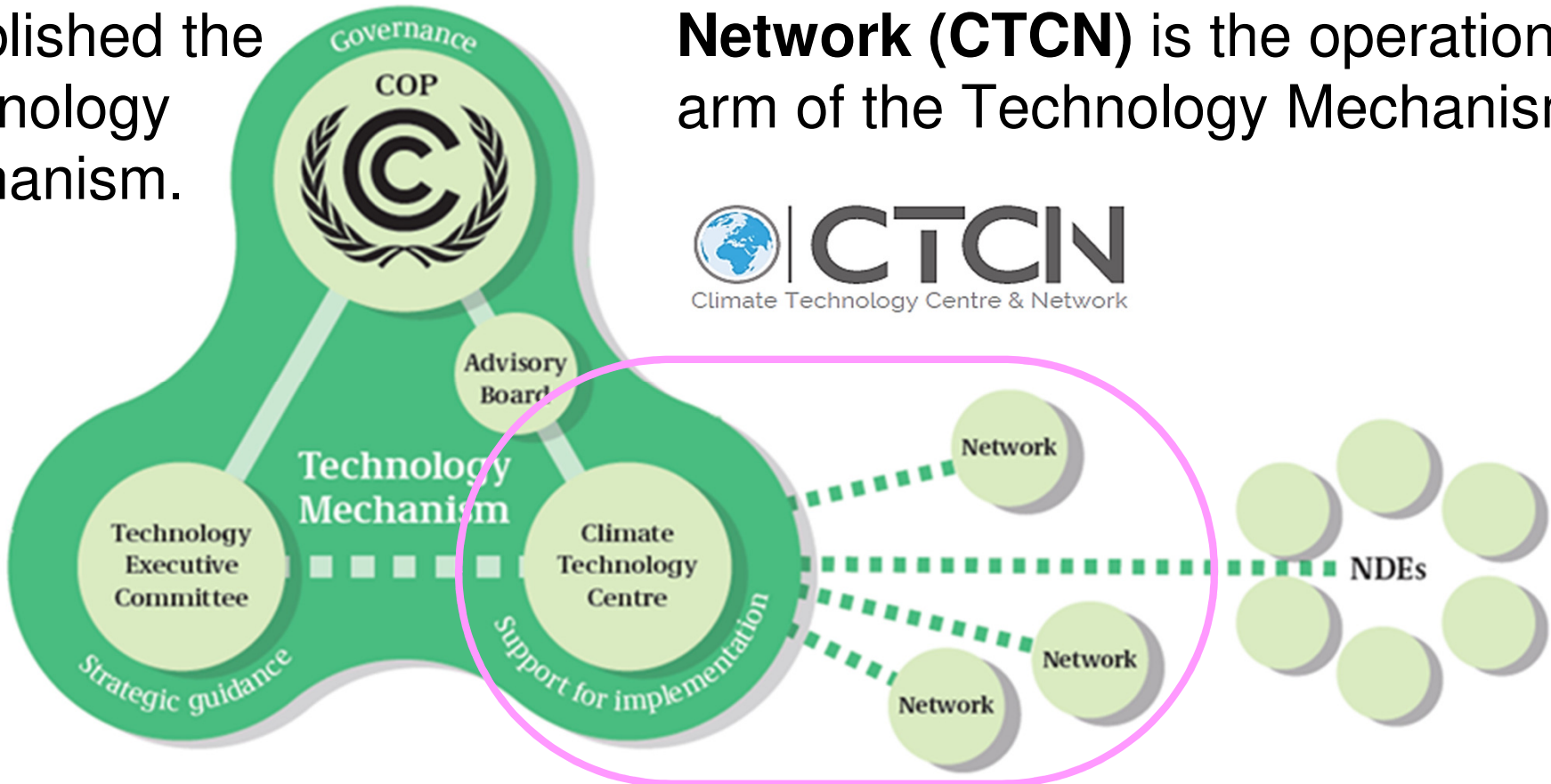
(Climate Technology Centre and Network)

- Expected energy consumption reduction by converting into membrane is 20-30%.

Electrolysis Process	Mercury	Diaphragm	Membrane
Energy efficiency	as 1.0	0.8-0.9	0.7-0.8

- **COP 16** in 2010 established the Technology Mechanism.

- **Climate Technology Centre & Network (CTCN)** is the operational arm of the Technology Mechanism.



Courtesy: Rajiv Garg, "CTCN: Support implementation of NAMAs"

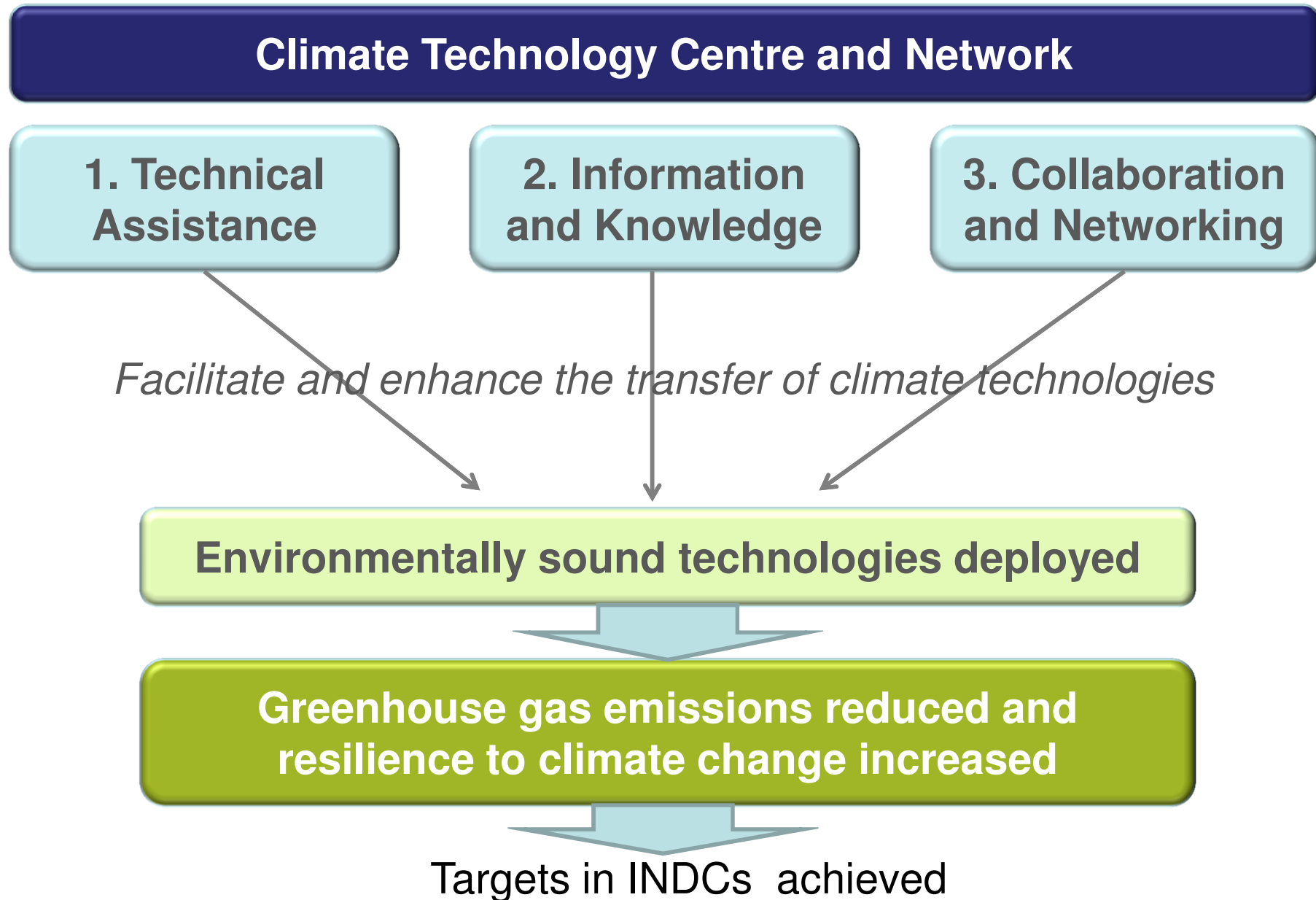


The CTCN's mission is "Stimulating technology cooperation and enhance the development and transfer of technologies to developing country Parties at their request"

Services:

1. Technical assistance to developing countries
2. Knowledge sharing and training
3. Fostering collaboration on climate technologies (including linking climate technology projects with financing opportunity)

Overview of CTCN Services



CTCN Technical Assistance

Fast and short (3 pages) application process for countries

Provided:

- To developing countries upon their request
- Free of charge (value up to 250,000 USD)
- State of the art and locally relevant expertise
- To academic, public, NGO, or **private entities**...



Thank you for your attention



**Chemistry
for a Blue Planet**
AGC Chemicals

私たちは化学の力を通じて、安全、安心、快適で、環境に優しい世の中を創造します。

Create a safe, secure, comfortable and environmentally friendly world with chemical technology.

通过我们的化学技术,来创造一个安全、安心、舒适且环保的世界!