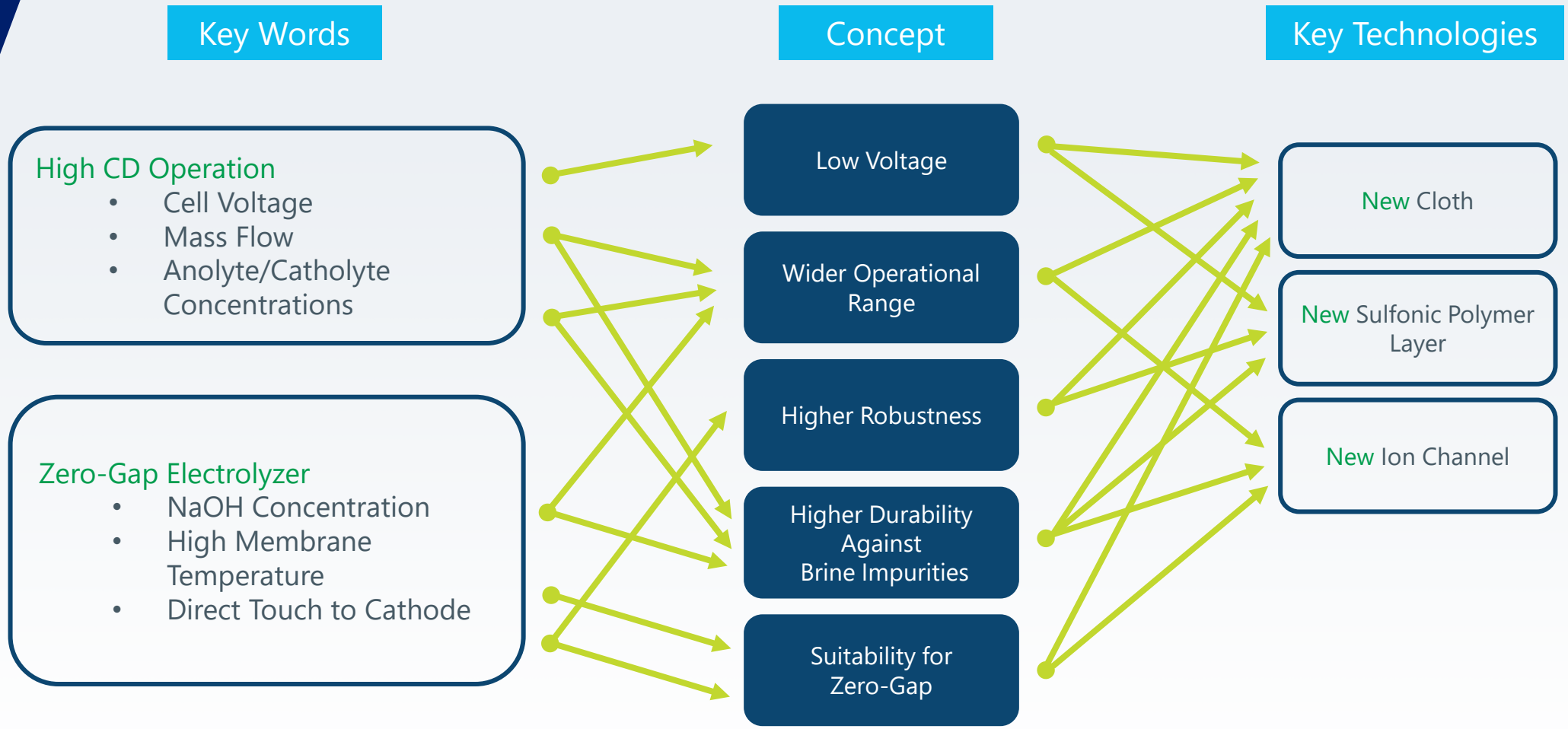
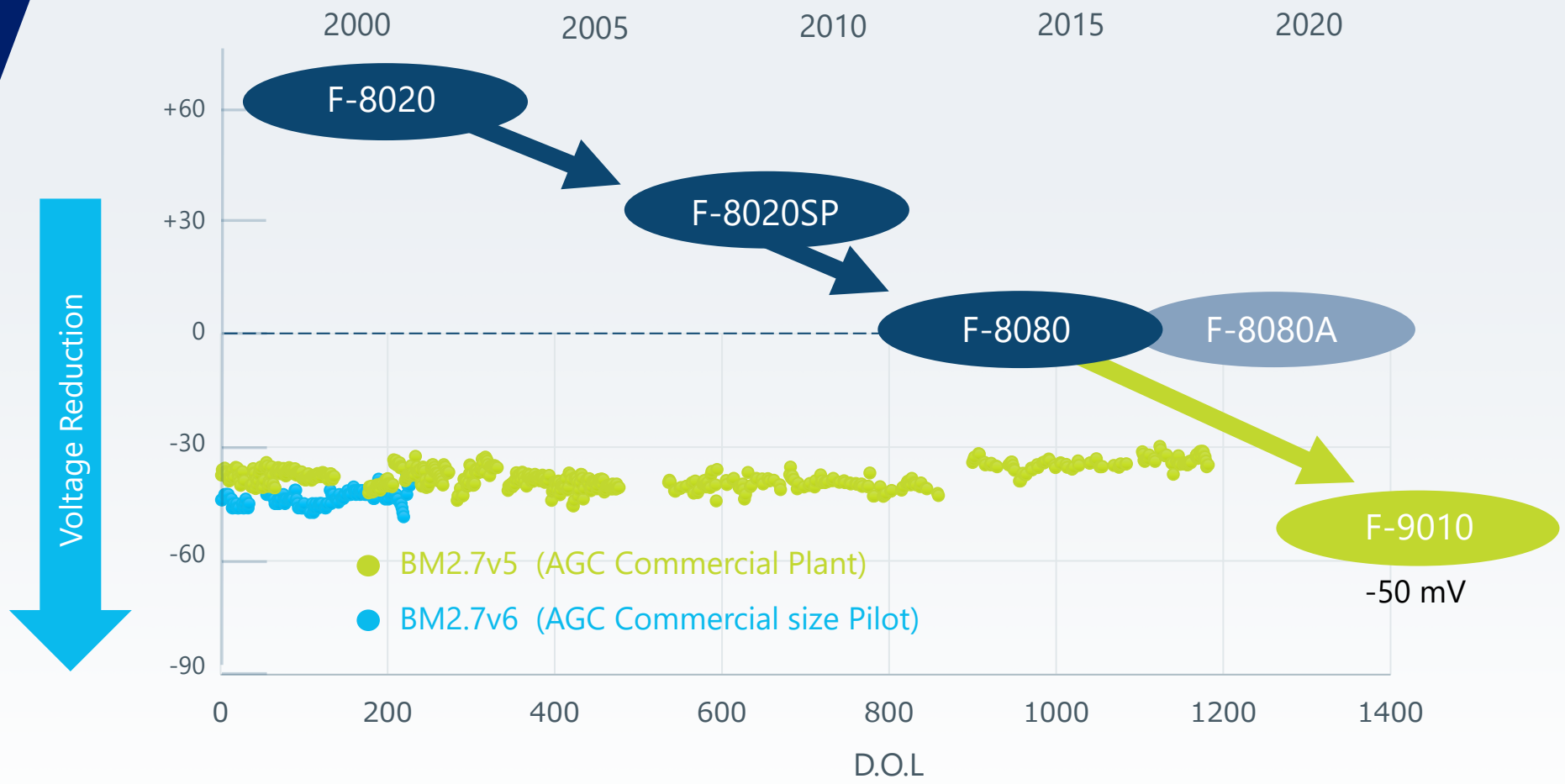
Introduction of FORBLUE™ FLEMION™ F-9010 Membrane

Key Technologies of F-9010



Voltage of F-9010 in AGC Commercial Electrolyzer

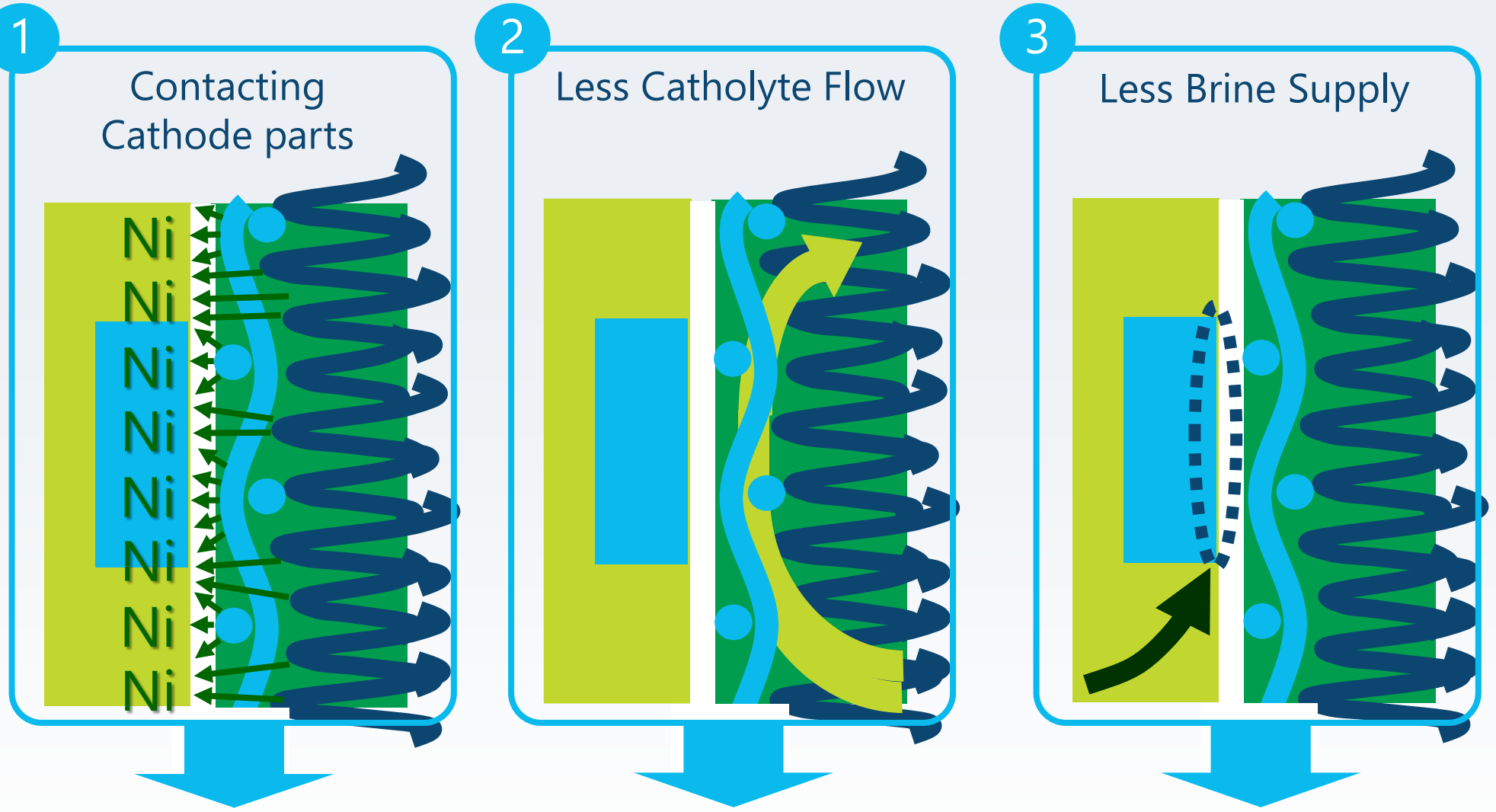


F-9010 membrane kept stable low voltage in AGC commercial electrolyzer more than 3 years.

Voltage of F-9010 in Commercial Electrolyzers

	Area	Electrolyzer Type	MOL		Comparison	Current Density **(kA/m2)**
A	SEA	CEC n-BiTAC	20	3 sheets	-80 mV vs. F-8080A	5.3 kA/m^2
B	China	AK　NCZ	10	4 sheets	-20 mV vs. Comp.-1	4 kA/m^2
C	China	CEC n-BiTAC	13	2 sheets	-60 mV vs. F-8080A	5.5 kA/m^2
D	China	CEC n-BiTAC	10	4 sheets	-40 mV vs. Comp.-2	5.5 kA/m^2
E	Europe	UHDE Gen5	12	10 sheets	-60 mV vs. F-8080A	6 kA/m^2
F	SEA	UHDE Gen5	11	6 sheets	-40 mV vs. F-8080A	6 kA/m^2
G	North America	UHDE Gen5	12	4 sheets	-50 mV vs. F-8080	6 kA/m^2
H	Japan	UHDE Gen5+	13	186 sheets	-70 mV vs. F-8080A	6 kA/m^2
I	Japan	CEC n-BiTAC	11	70 sheets	-50 mV vs. F-8080A	6 kA/m^2
J	Japan	CEC BiTAC	12	25 sheets	-30 mV vs. Comp-2	5 kA/m^2
K	North America	CEC BiTAC	8	4 sheets	-30~40 mV vs. Comp-2	5 kA/m^2
L	North America	CEC BiTAC	6	4 sheets	-100 mV vs. Comp-3	5 kA/m^2

“Zero Gap” Advantages

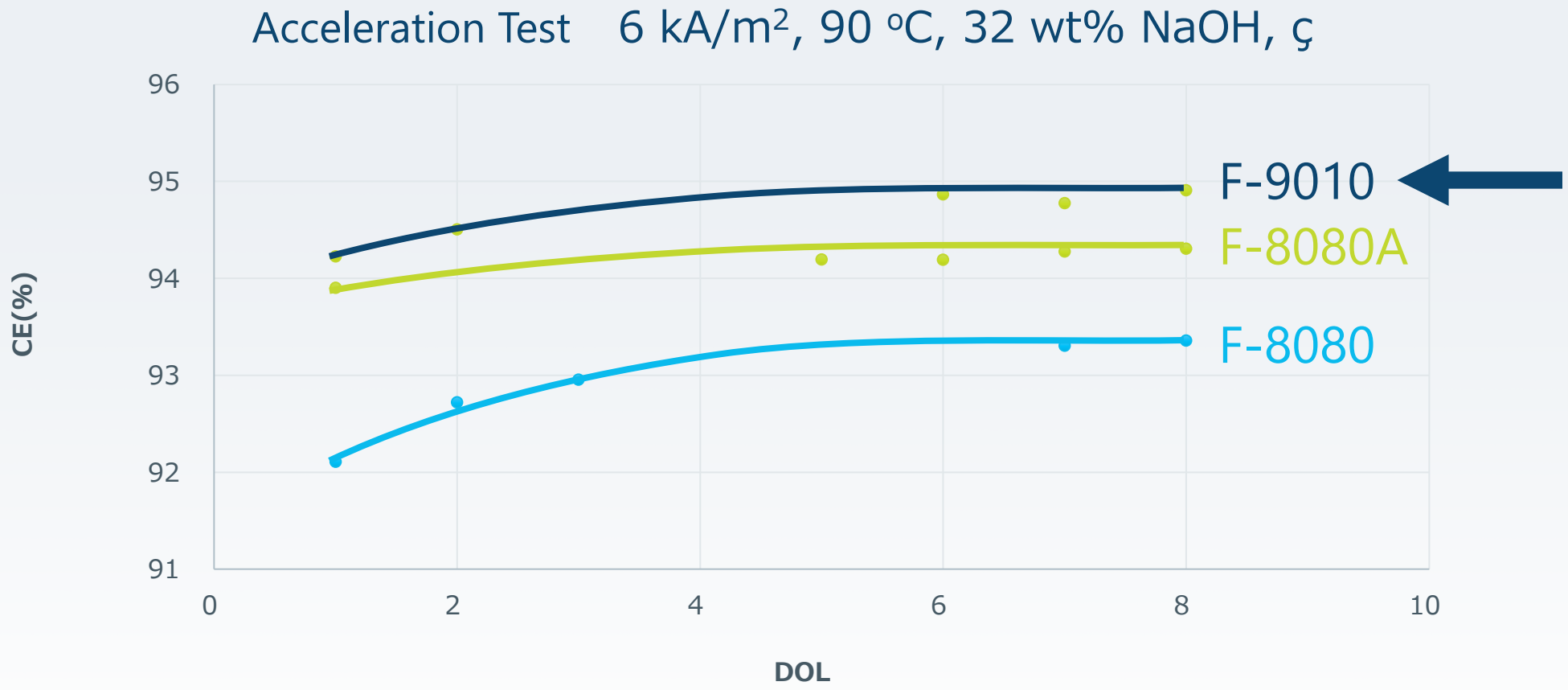


Ni stain

High Temperature

Weak brine

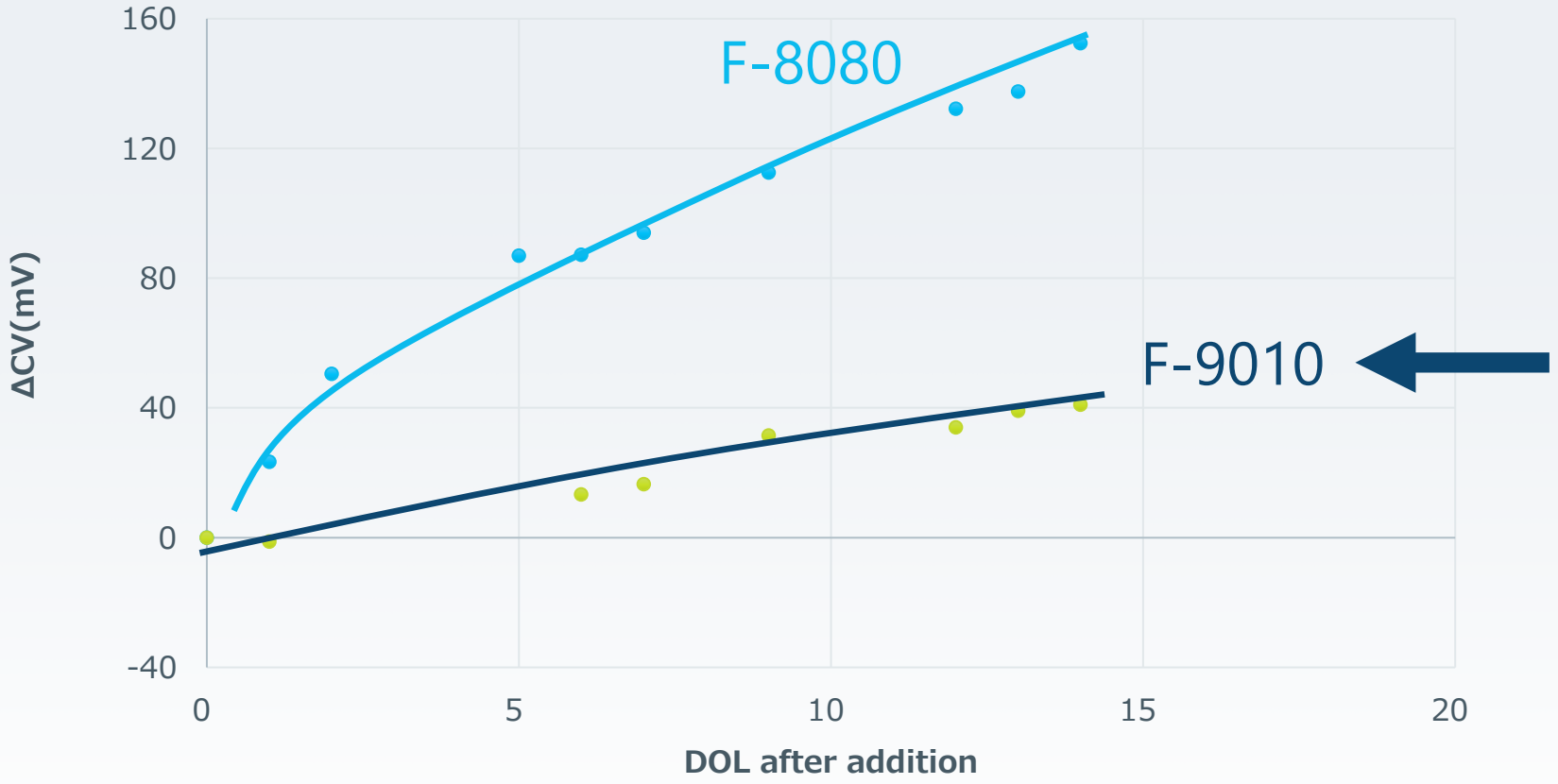
Durability Against Ni Stain (for Zero Gap)



F-9010 shows higher stability of CE against Ni stain.

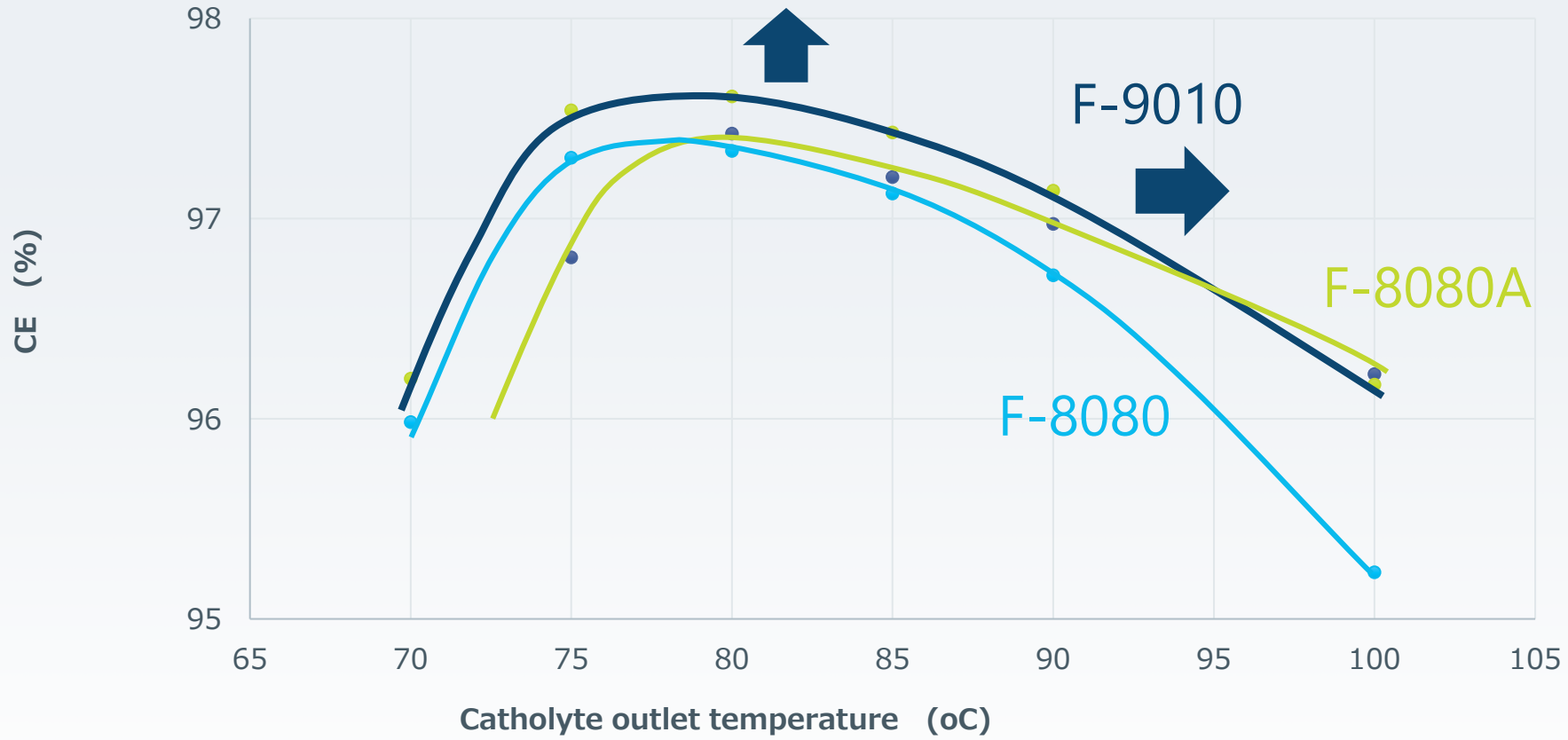
“New Ion Channel” is applied.

Durability Against Ni



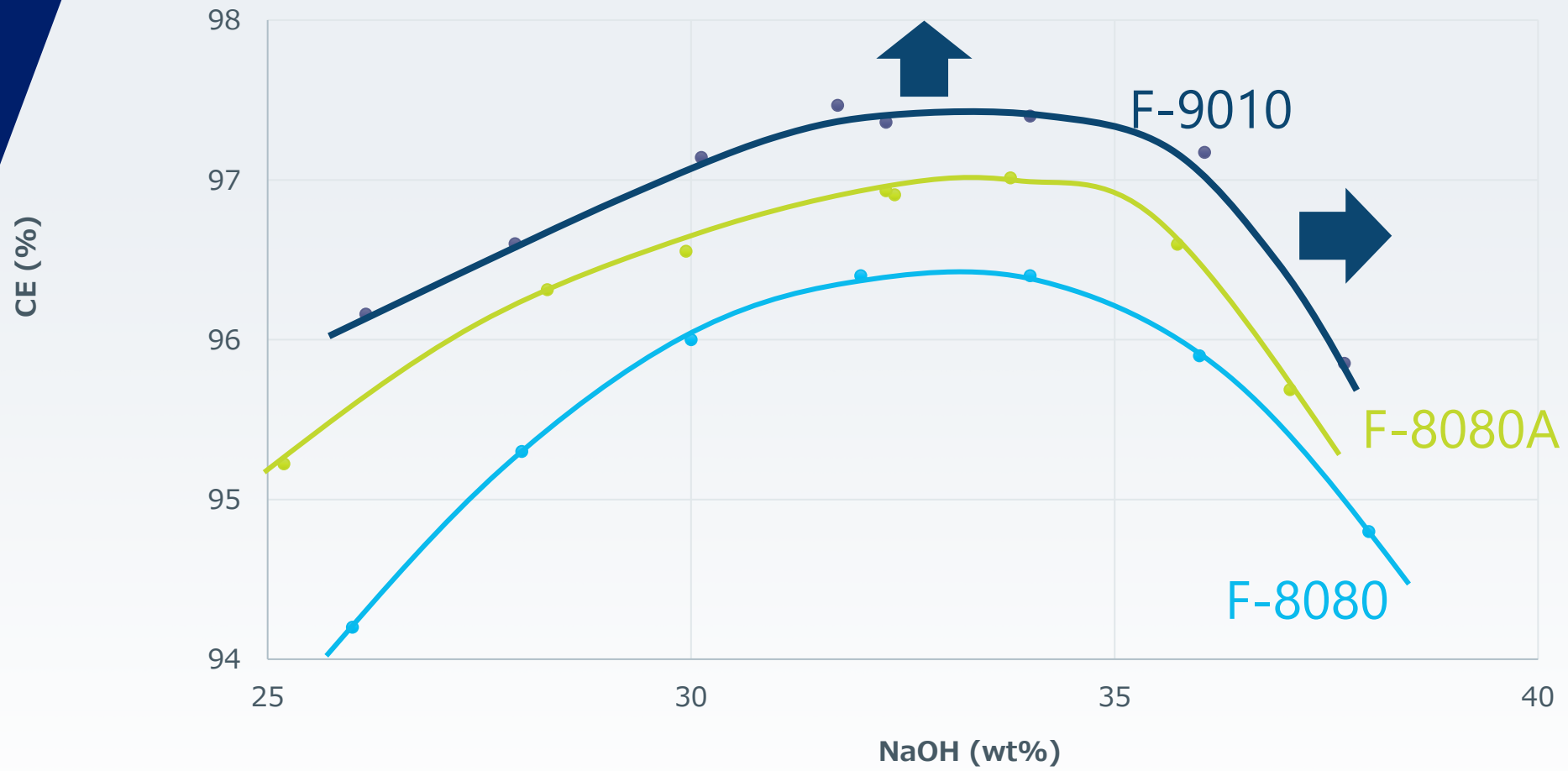
F-9010 has higher stability of CV against Ni.

Higher CE in Wider Temperature Range



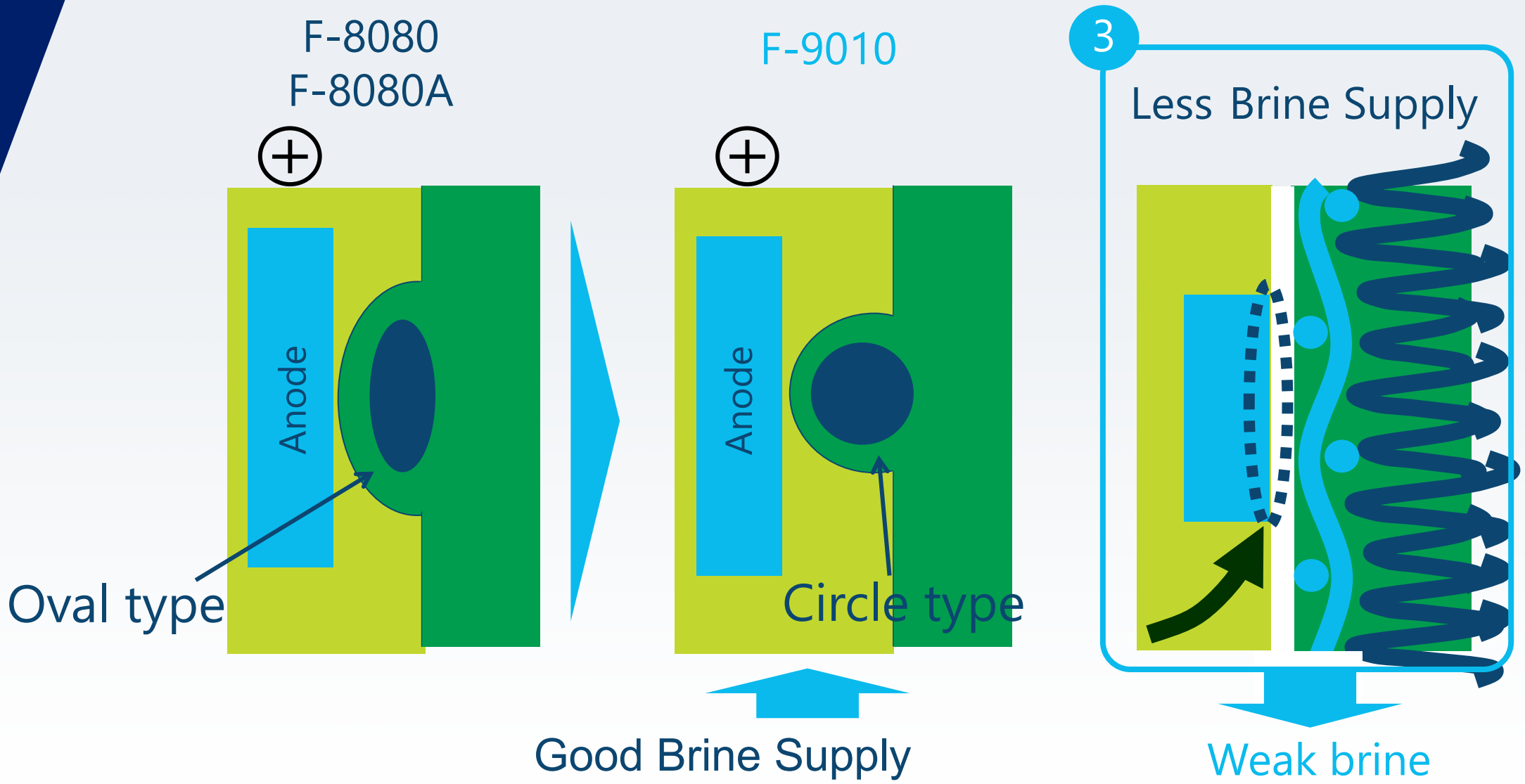
F-9010 shows higher CE at high and low temperatures.

Higher CE in Wider Range of Caustic Strength

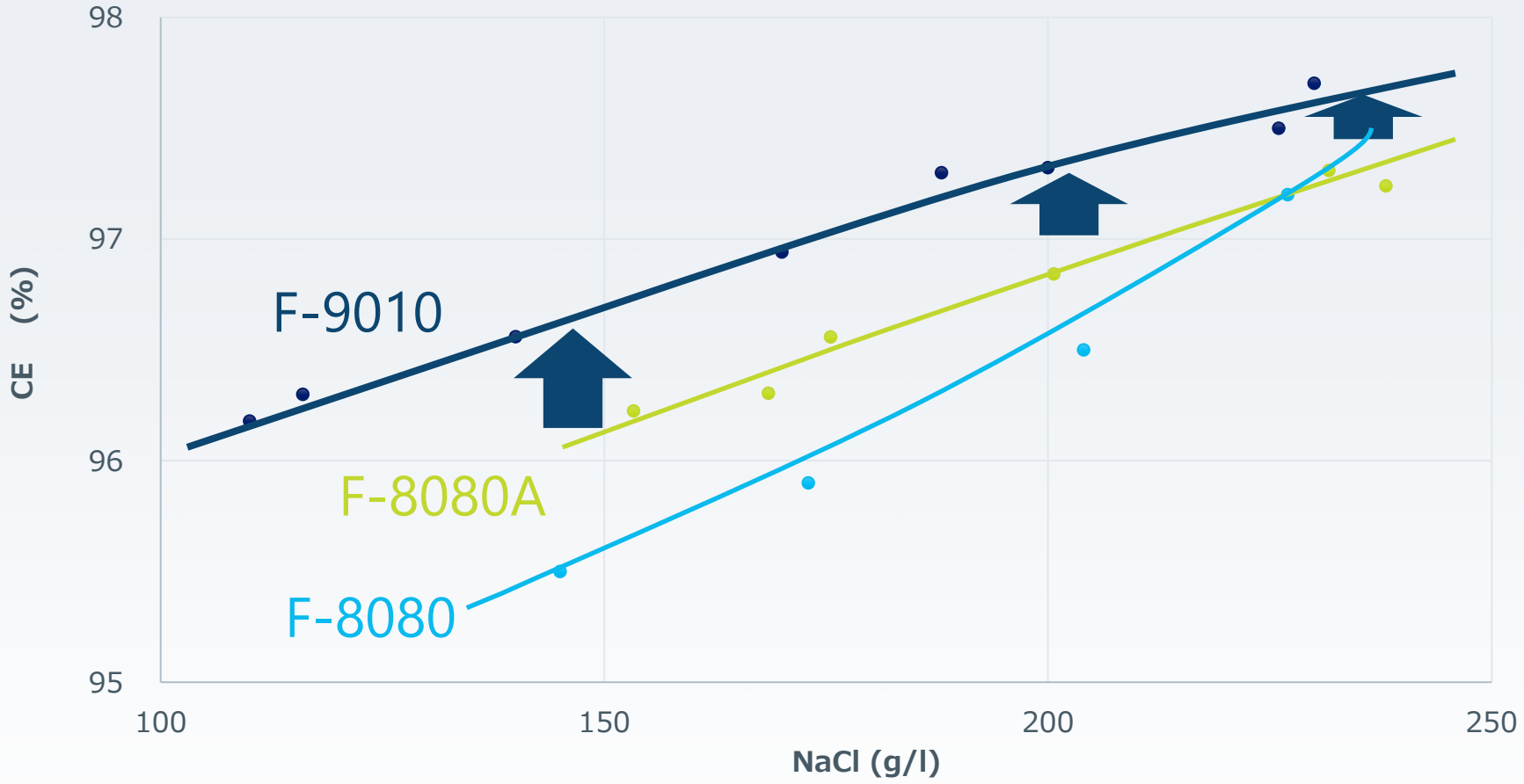


F-9010 shows higher CE in weak and strong caustic.

Proper Surface Shape Causes Good Brine Supply

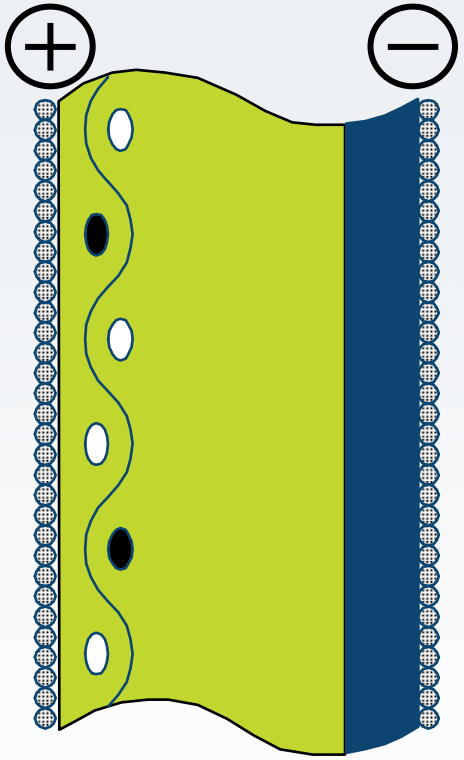


Higher CE in Weak Brine



- F-9010 shows higher CE in weak brine.
- It is suitable for electrolyzers with less inner circulation of brine.

Membrane Design for Low Cell Voltage



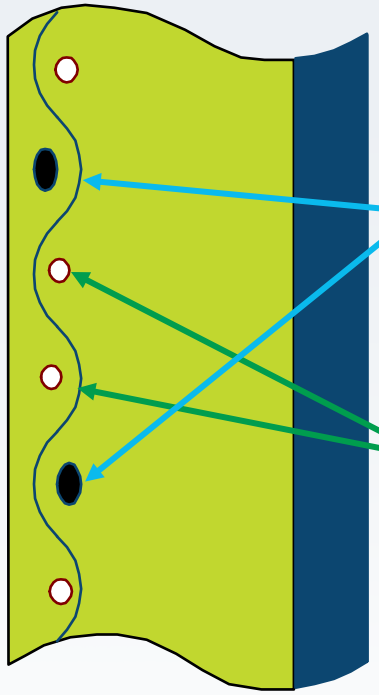
- Reduced Membrane Thickness
- Improved Reinforcement
- Optimized Polymer
- Improved Surface Coating

"Shadow influence"

Reducing Shadow influence with "New Cloth"

Standard Cloth

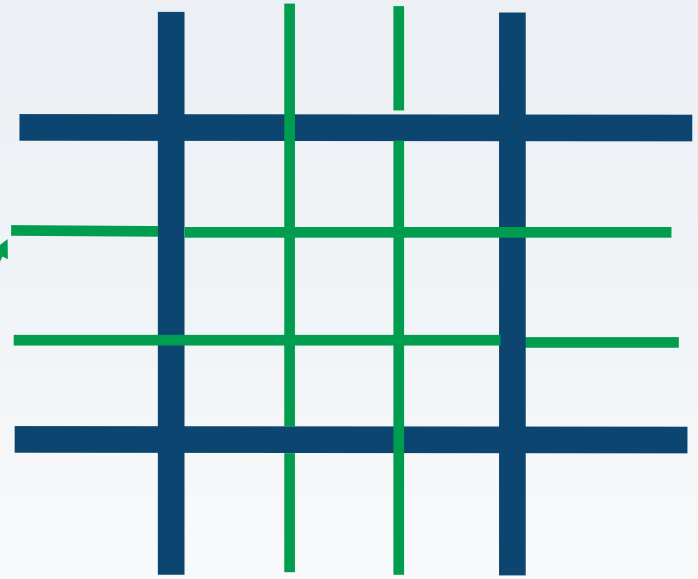
Cross Section



Permanent Fiber
(PTFE fiber)

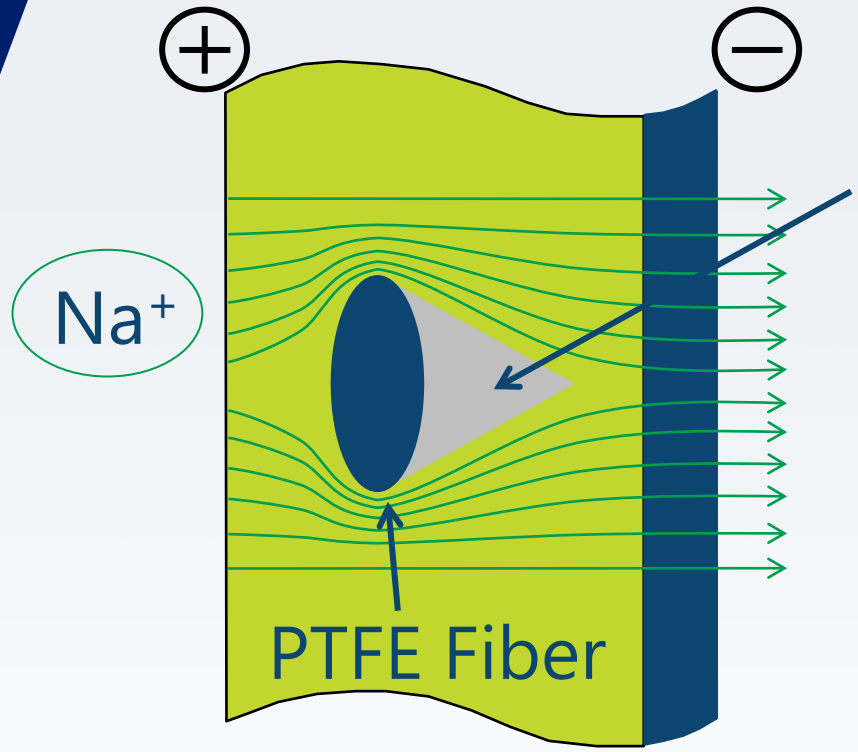
Sacrificial Fiber
(PET fiber)

Plane Figure



Standard Cloth: Plain-woven fabric, PTFE and PET fiber.

Influence of Cloth on Cell Voltage



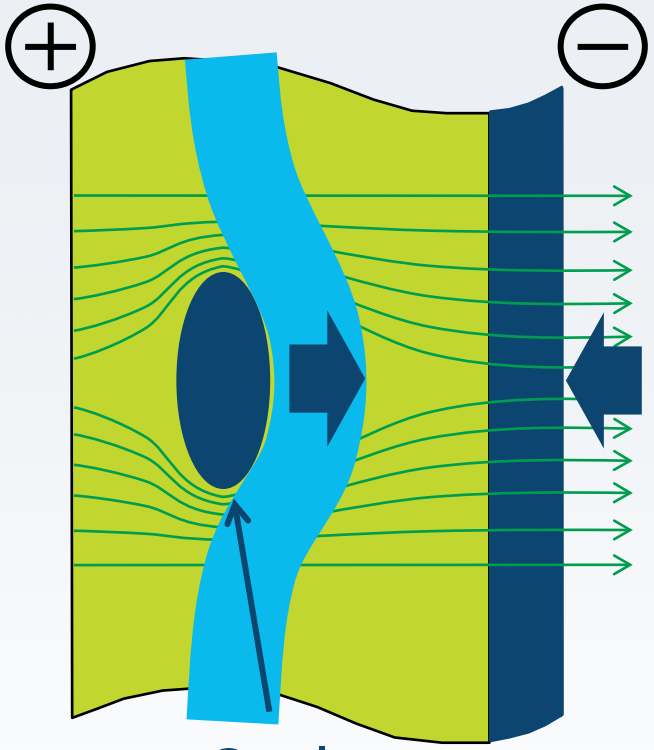
“Shadow”

PTFE fiber interferes with the Na^+ migration, which increases cell voltage.

Two kinds of teeth reduces the shadow influence.

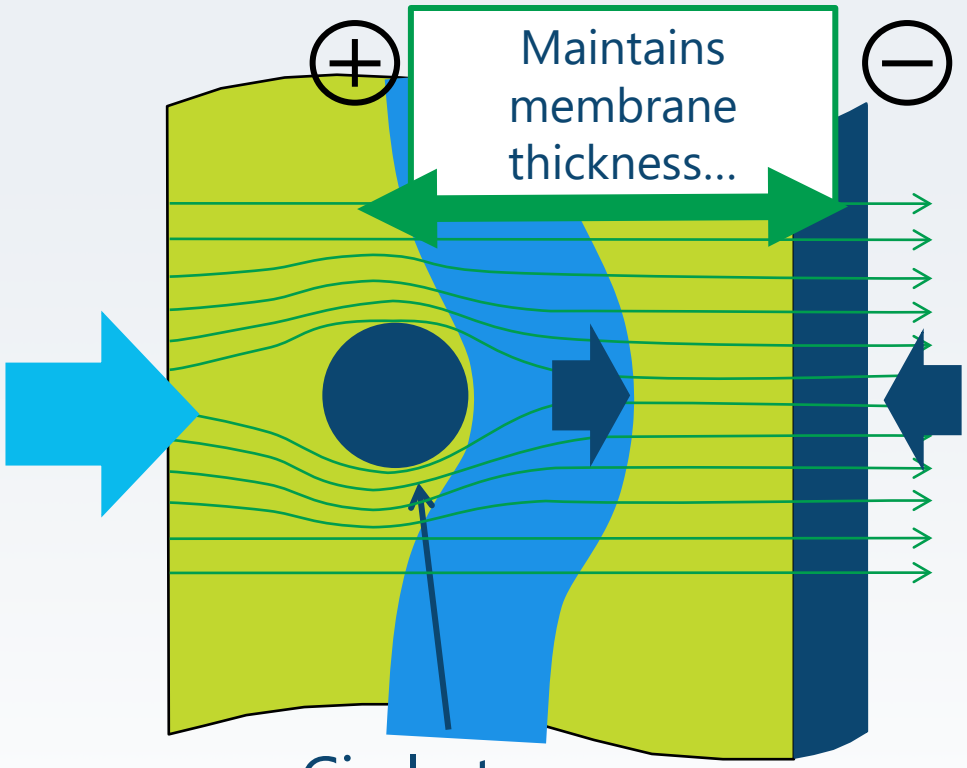
Reducing Shadow Influence (1)

Conventional Cloth



Oval type

Flemion F-9010

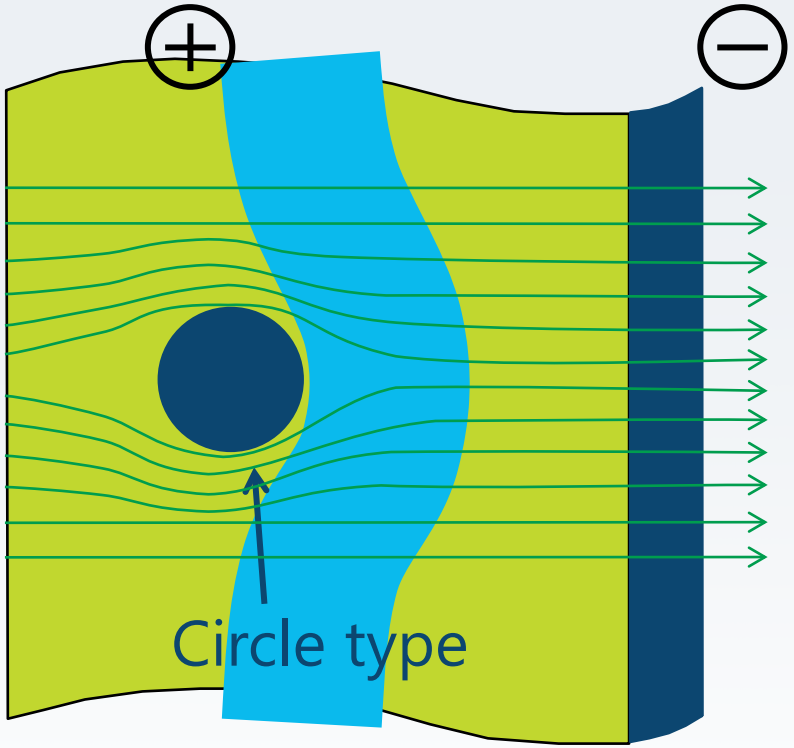


Circle type

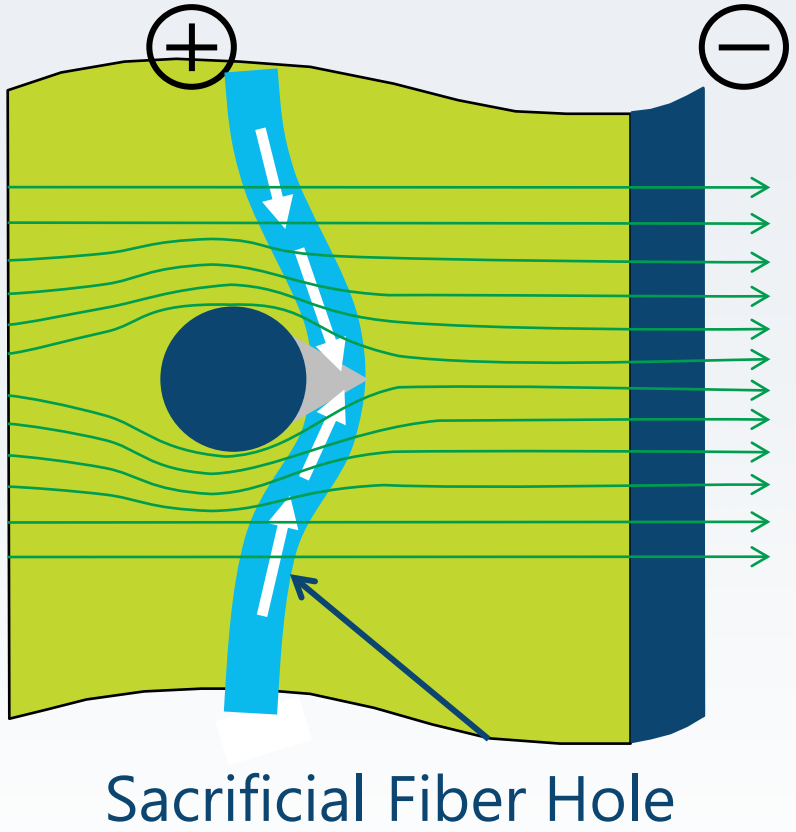
Proper surface shape reduces cell voltage.

Reducing Shadow Influence (2)

New Cloth: PTFE



New Cloth: PET

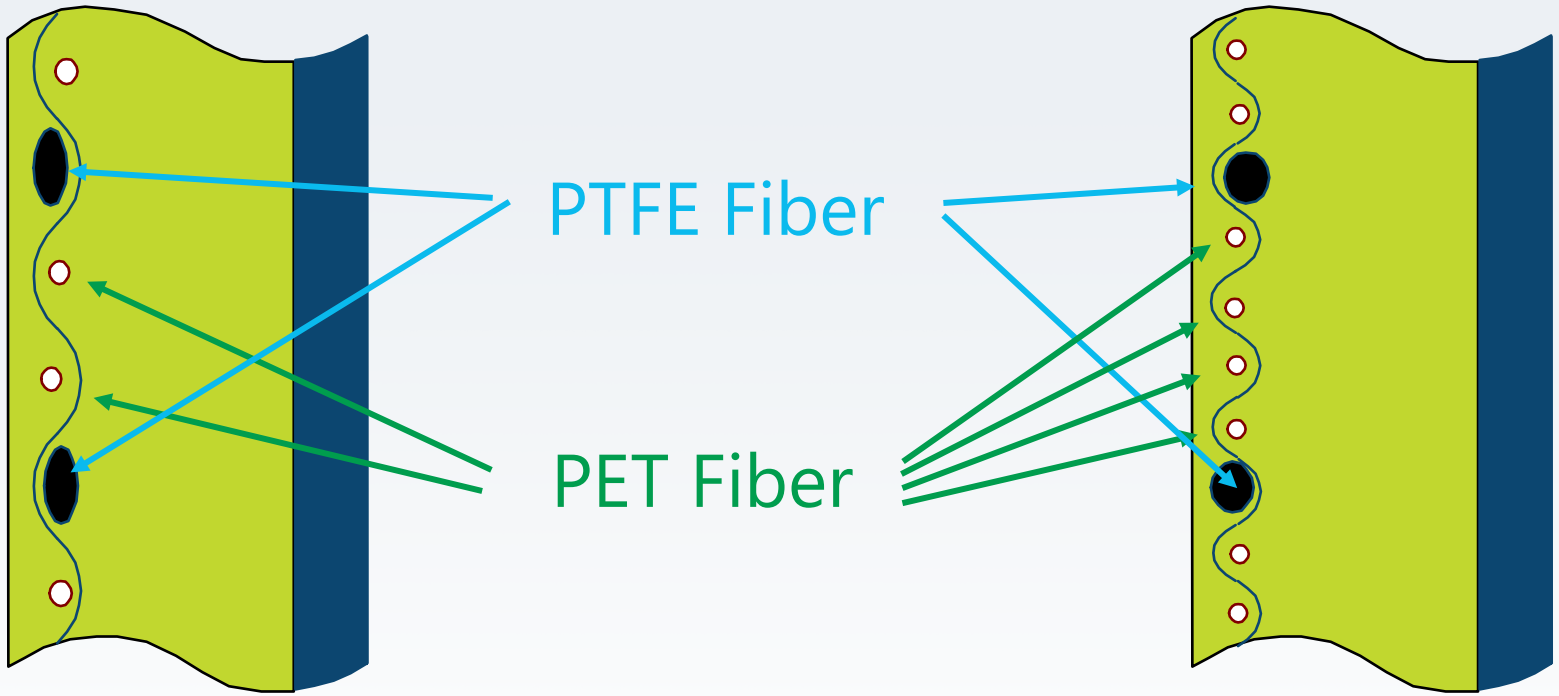


PET fiber dissolves under the electrolysis and makes sacrificial fiber holes, which reduce the shadow influence.

Reducing Shadow Influence (2)

F-8080/F-8080A Cloth

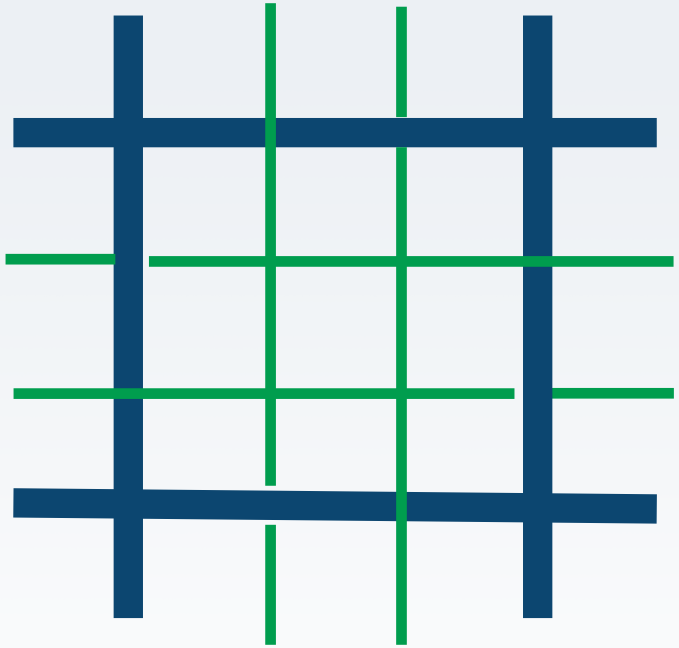
F-9010 Cloth



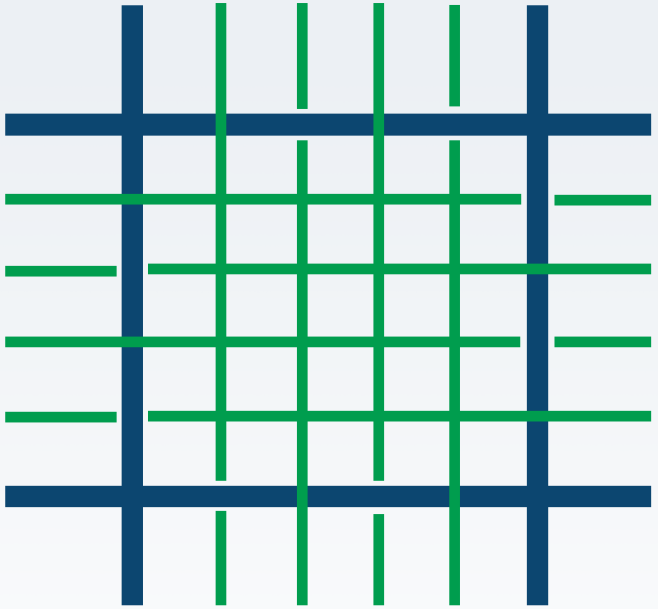
F-9010 cloth has 4 PET fibers between PTFE fibers,
which further reduces the shadow influence.

Reducing Shadow Influence (2)

F-8080/F-8080A Cloth



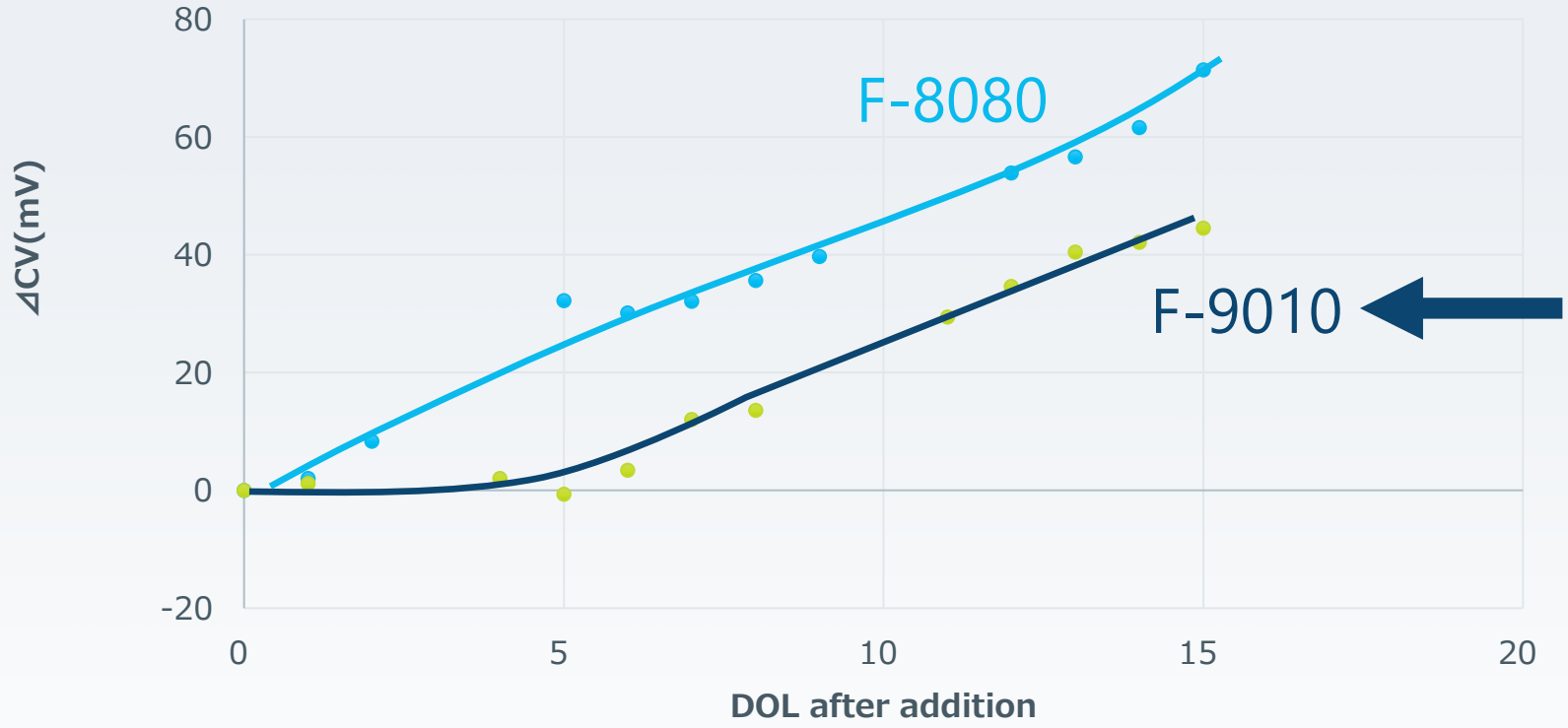
F-9010 Cloth



F-9010 cloth further reduces the shadow influence and makes F-9010 show lower voltage.

Durability Against Mg

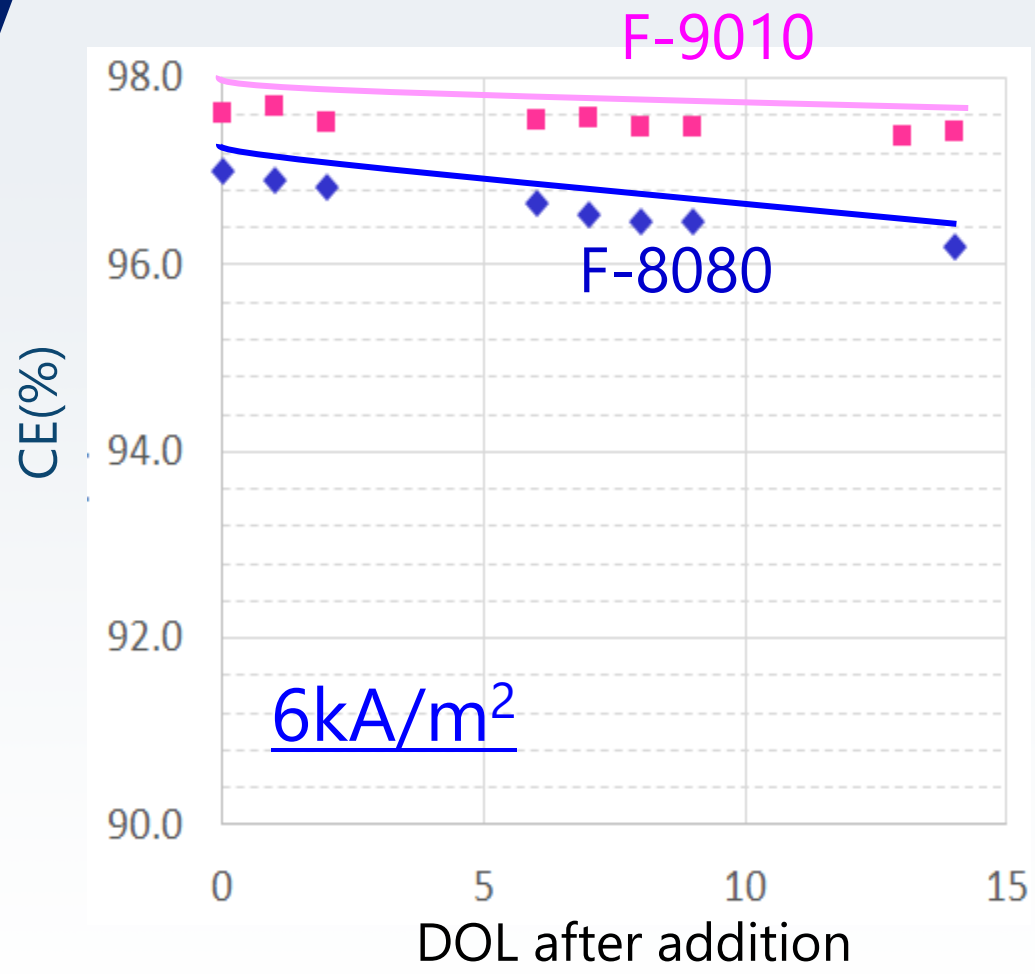
8 kA/m^2, 90 ^{o}C, 32 wt% NaOH, Mg=0.1 ppm

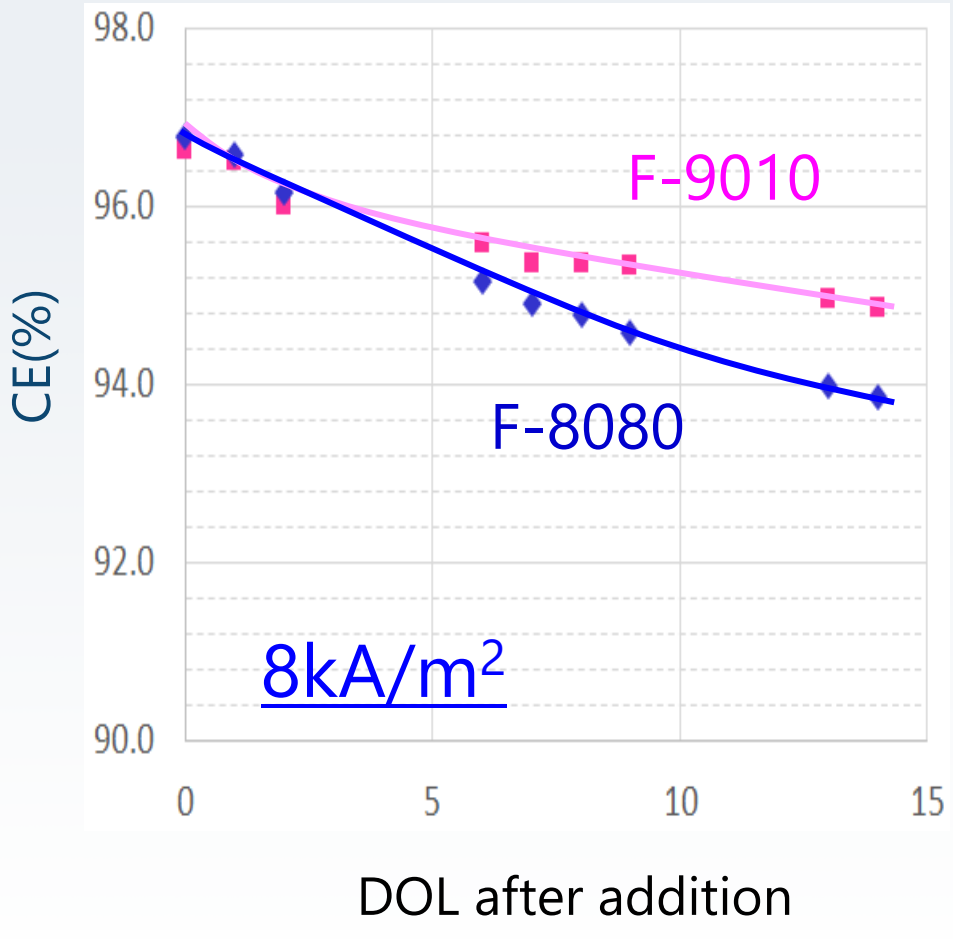


F-9010 has higher stability of CV against Mg.

Durability Against Al/SiO_2

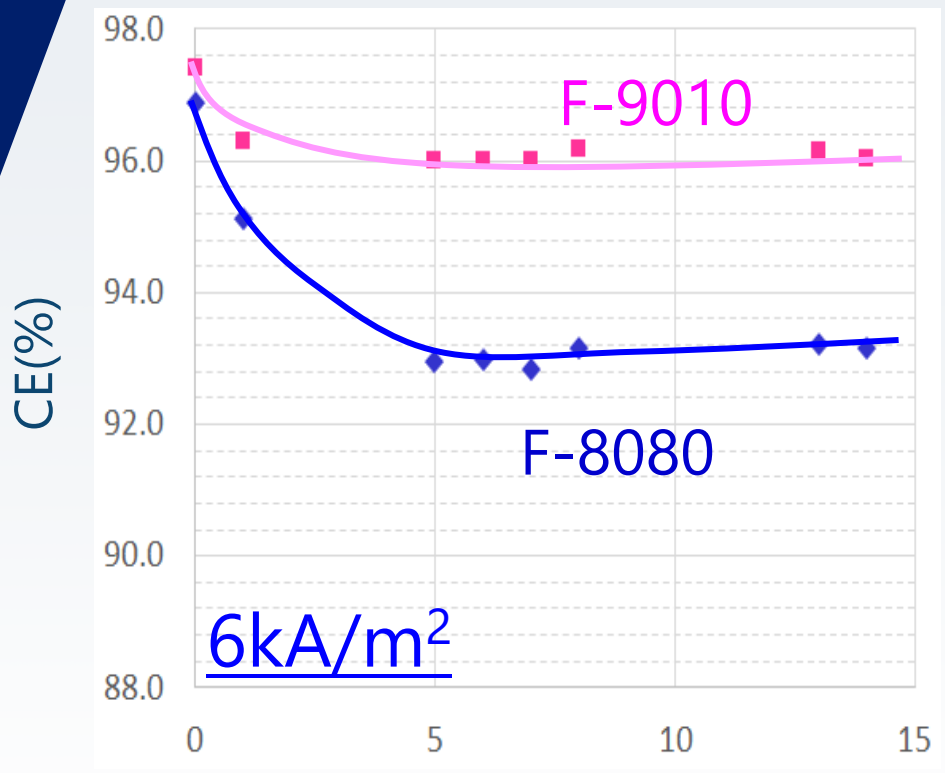
85 °C, 32wt% NaOH, Al/SiO_2=1/30ppm

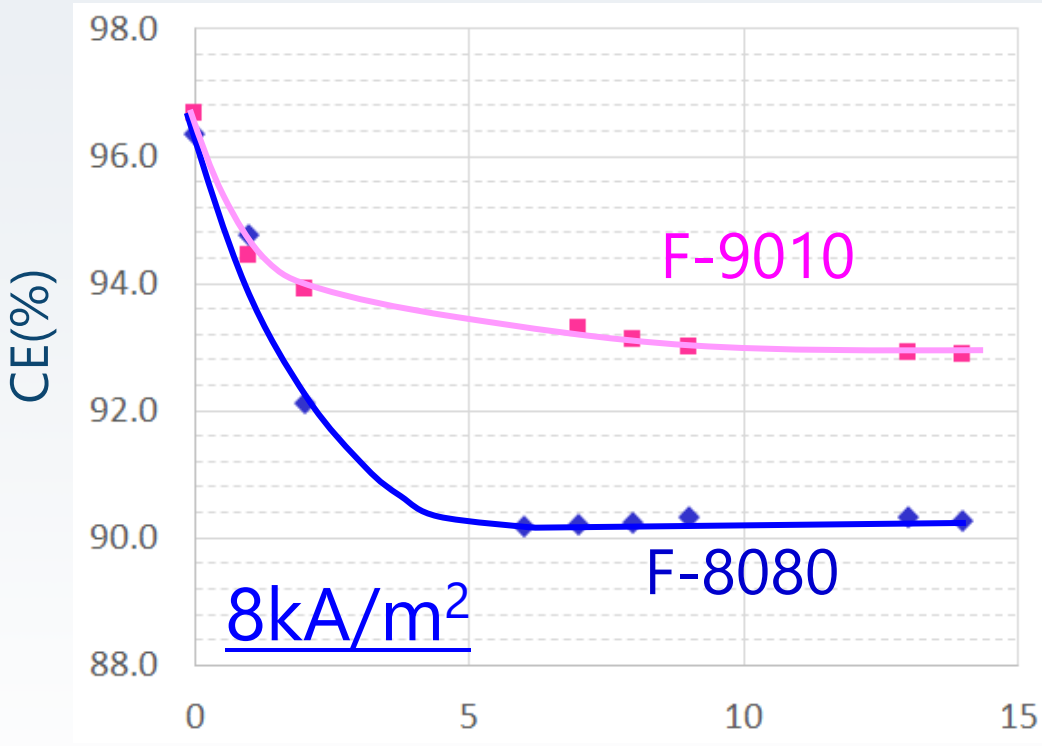




Durability Against Ca/SiO_2

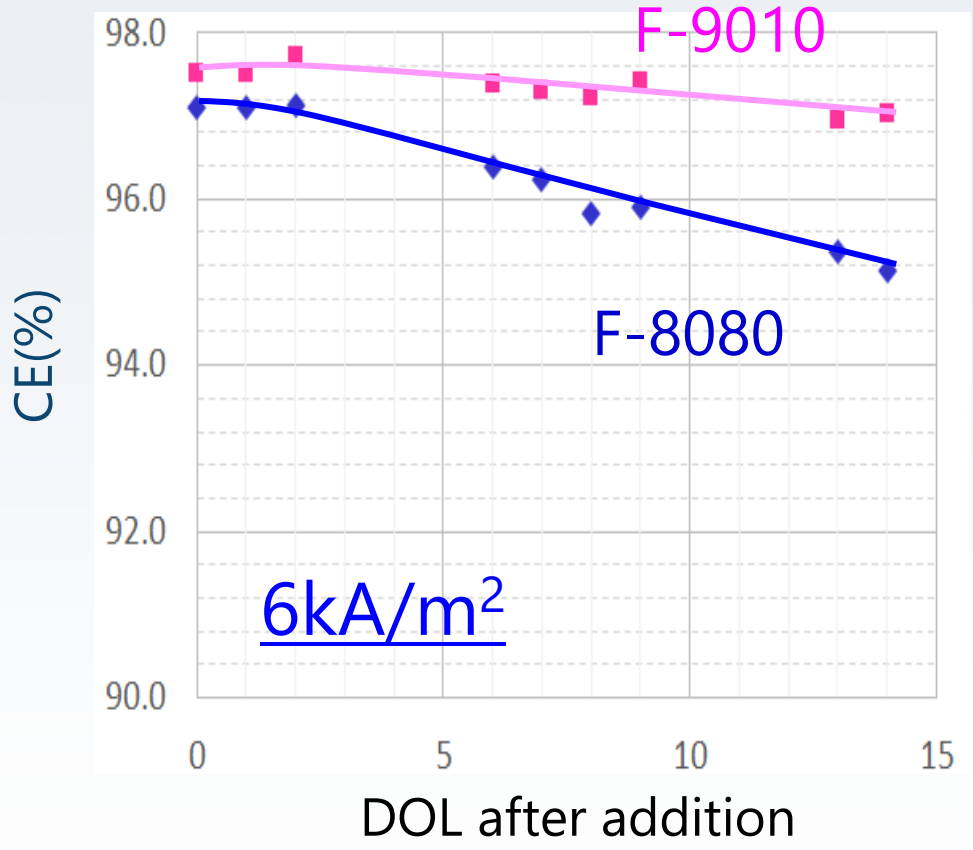
85 °C, 32wt% NaOH, $Ca/SiO_2 = 0.05/15ppm$

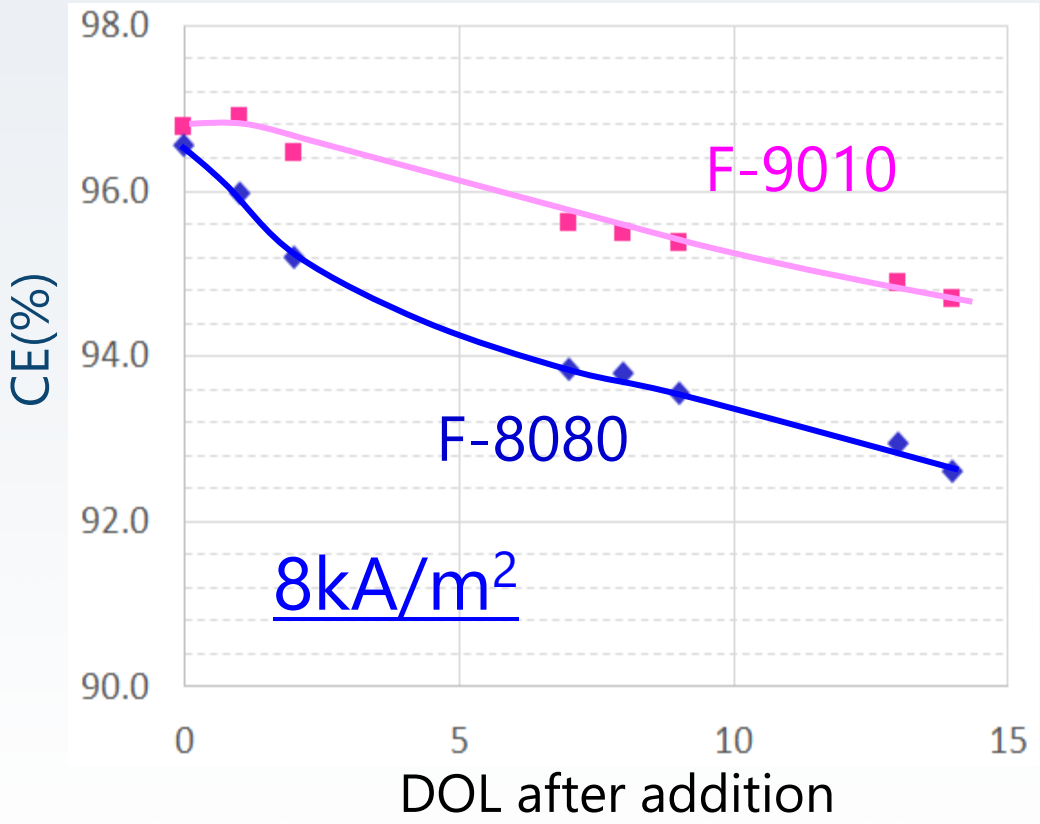




Durability Against I/Ba

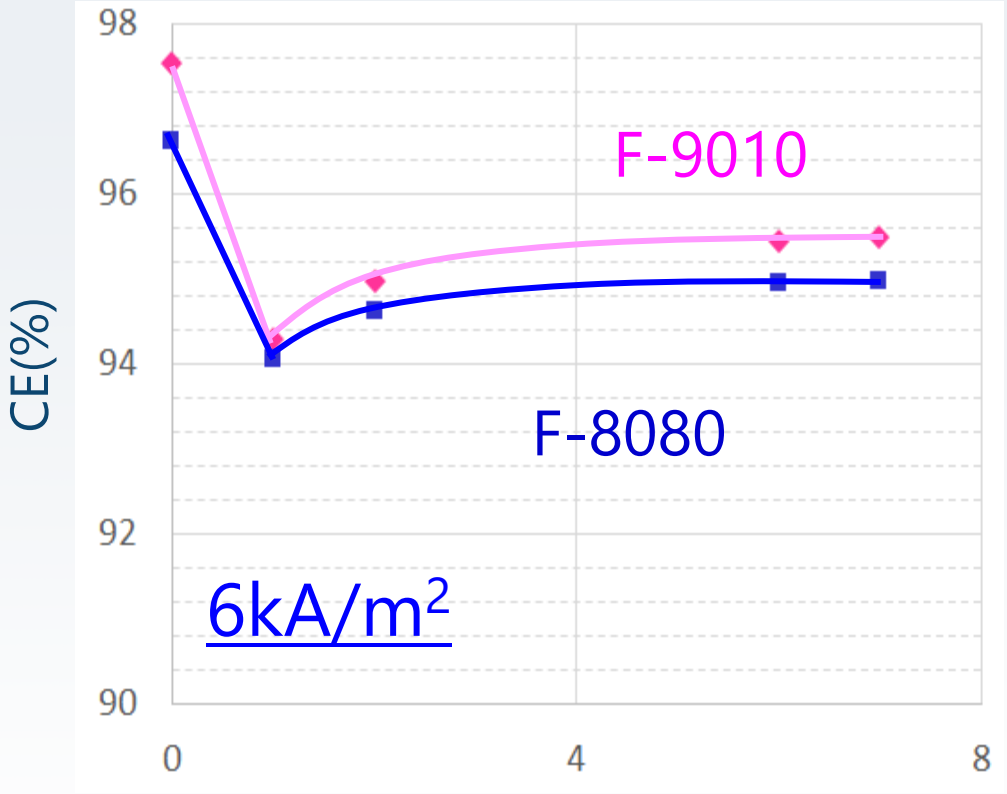
85 °C, 32wt% NaOH, I/Ba=20/1ppm

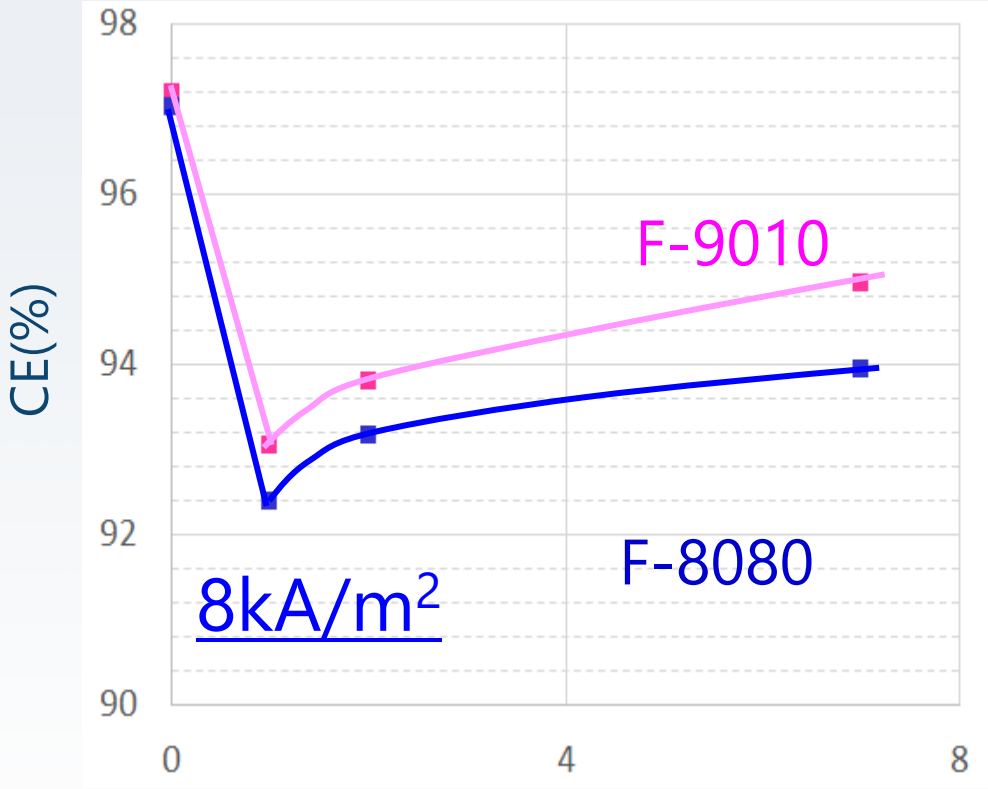




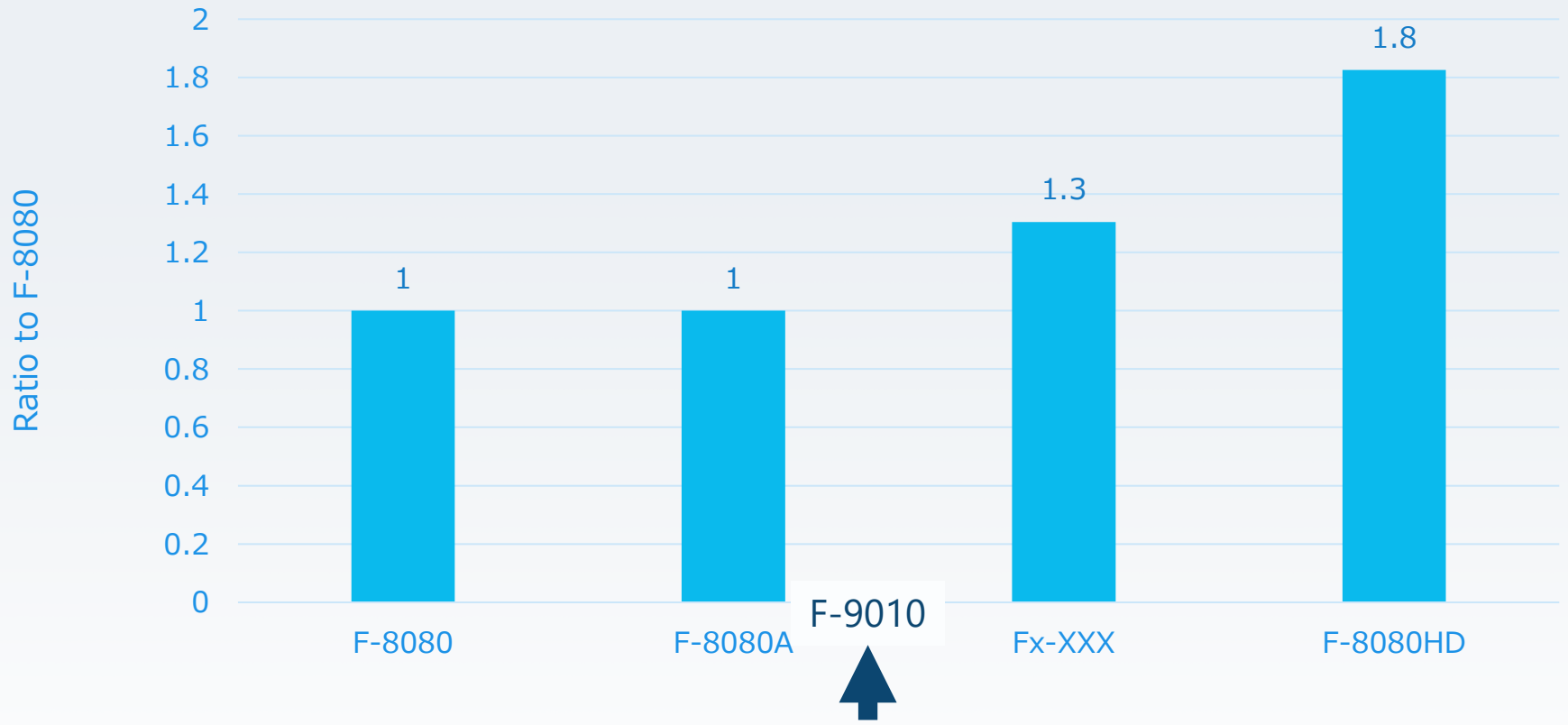
Durability Against Ca Upset

85 °C, 32wt% NaOH, Ca=1.5ppm, 4hr





Frequent Load Tensile Test



F-9010 is more robust than F-8080 and F-8080A.

For More Information:

Katie Jarvis
Katie.Jarvis@agc.com