



SUPERCAPACITOR & FUEL CELL COMPONENT



VINATech
Vision for Nature

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ABOUT VINATECH



SUPERCAPACITOR



World's Leading Manufacturer of Supercapacitors and Fuel Cell Components

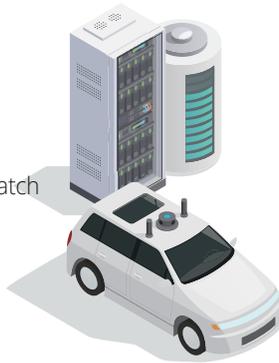


SUPERCAPACITORS PRODUCT APPLICATIONS AREA



AUTOMOTIVE & AFTER-MARKET

- Navigation and Dash Camera
- Memory Back Up, RTC power
- Compensate peak power
- Vehicle tracking and security
- Fail Safe applications, E-Call & E-Latch
- Braking System



SENSOR NETWORKS, COMMUNICATIONS

- Long Term Back Up
- Pulse management
- 3.8 V Lithium Capacitor



UNINTERRUPTIBLE POWER SUPPLY(UPS), DYNAMIC VOLTAGE RESTORER(DVR)

- Responds to momentary blackouts
- Compensate peak power
- Engine cranking



SMART METERS / NETWORK EQUIPMENT

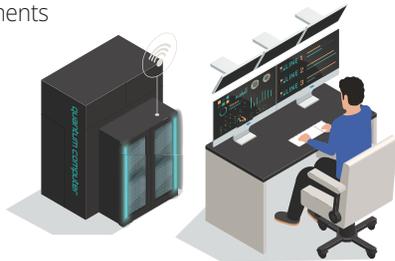
- Long life : No maintenance
- Wider operating temperature : -40 °C to +85 °C





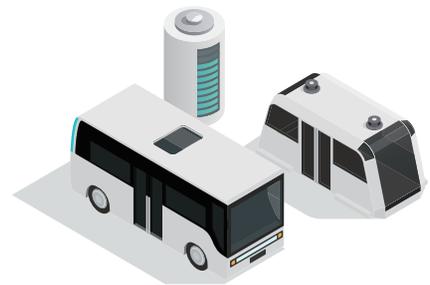
MEMORY BACK UP

- RAID, SSD, NVDIMM, DRAM to NAND Flash, Cache protection power backup
- Applied spec. : 3.0 V (1 F ~ 100 F)
- Circuit configuration based on cache density and power requirements



REGENERATIVE ENERGY STORAGE DEVICE

- Hybrid electric cars, suitable for elevators or railway vehicles
- Reduce energy cost and CO₂ emission



WIND TURBINE

- Pitch control
- Compensate peak power
- Semi permanent and no maintenance



OTHER APPLICATION

- Medical & Dental equipment
- Actuators and Locking systems
- Building controls, Drones and Toys
- Robotics AGV Fault Indicators



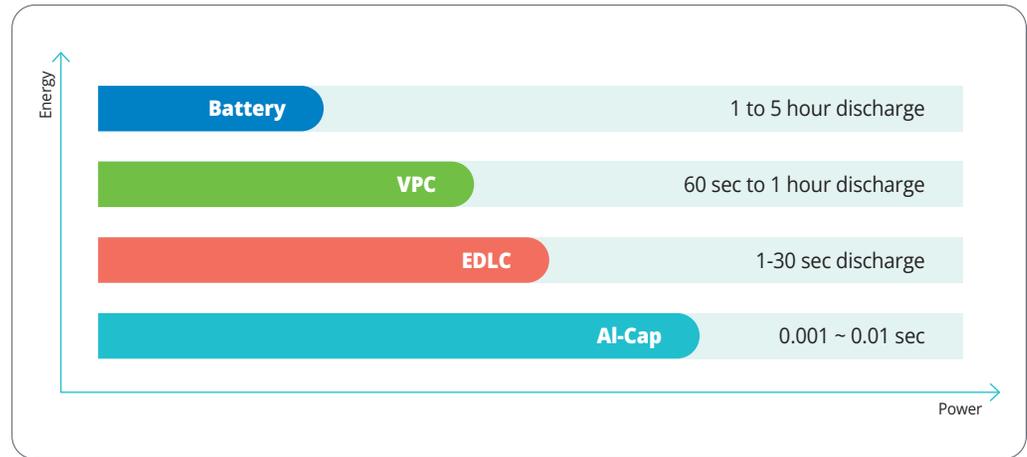


SUPERCAPACITORS INTRODUCTION

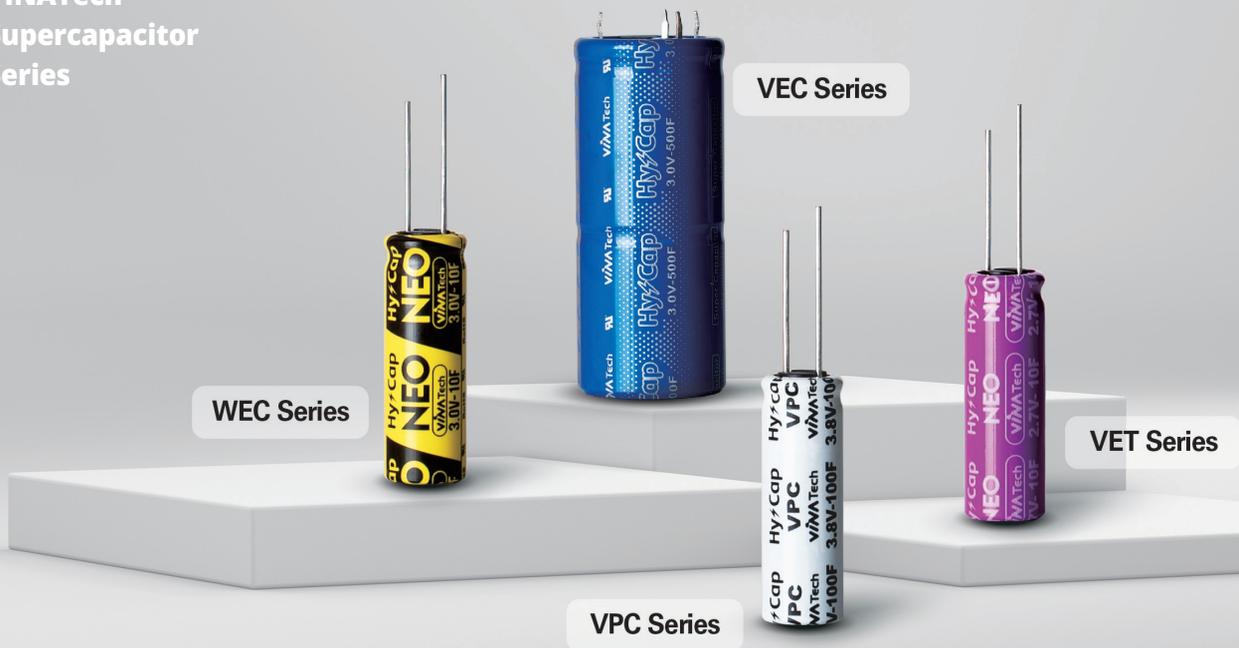
Environment-friendly Energy Storage Device

ELDC Capacitor (Electric Double Layer Capacitor also known as Super Capacitor or Ultra Capacitor), are environmentally friendly energy storage devices with low energy density and high power density when compared to Battery technology. The advantages of ELDCs are high current, fast charge and discharge, long cycle life (500,000+ cycles) and long lifetime with wide temperature ranges (-40°C ~ +65°C, +85°C when derated) RoHS, REACH & WEEE compliant safe for transportation.

VPC ranges are the new high density environmentally friendly Hybrid Lithium Capacitor offering high energy, low ESR and ultra low Leakage Current in small packages.



VINATech Supercapacitor Series



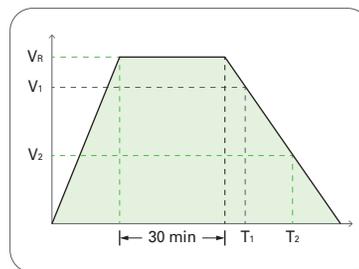


SUPERCAPACITORS CHARACTERISTICS

Product Series	EDLC (VEC/WEC)	EDLC (VET)	VPC (VEL)
Rated Voltage	3.0 V	2.7 V	Operating Voltage Range 2.5 V to 3.8 V
Operating Temp.	-40 °C ~ +65 °C (+85 °C when de-rated)	-40°C ~ +85 °C	-25°C ~ +70°C
High Temp. Load life	1000 hours / V _R loaded under 65 °C	1000 hours / V _R loaded under 85 °C	1000 hours / 3.8 V loaded under 70 °C
Capacitance	≤ 30 % of initial value		≤ 30 % of initial value
ESR	≤ 2 times of specified value	≤ 3 times of specified value	≤ 2 times of initial spec value
85 °C Voltage	De-rated voltage Max 2.4 V	Rated Voltage 2.7 V	Operating Voltage Range 2.5 V to 3.5 V
Cycle	500,000		20,000
Shelf life storage	3 years from manufacturing date No electrical charge & Temp. below 25 °C (ΔC : ≤ 10% of initial value / ΔESR : ≤ 50 % of specified value)		3 years from manufacturing date Temp. below 25 °C Recommend every 6 month to charge V _R from manufacturing date (C ≤ 10 % of initial value / ESR ≤ 100 % of initial spec value)

Measurement of Capacitance & ESR

Capacitance (F)



$$C(F) = I \times \frac{(T_2 - T_1)}{(V_1 - V_2)}$$

V _R	Rated Voltage
V ₂	0.8 V _R
V ₁	0.4 V _R
I	Discharge Current

DC ESR(Rd) is calculated by voltage drop (ΔV) which is measured by the period of time from discharge start to 10 milli - seconds later.

Equivalent Series Resistance (ESR)

AC ESR is measured by 4 - probe impedance analyzer.

* Condition : Potentiostat mode, AC amplitude : 5 mV, Frequency : 1 kHz

VPC Measurement of Capacitance

C : Discharge capacitance (F)

I : Discharge Current (A)

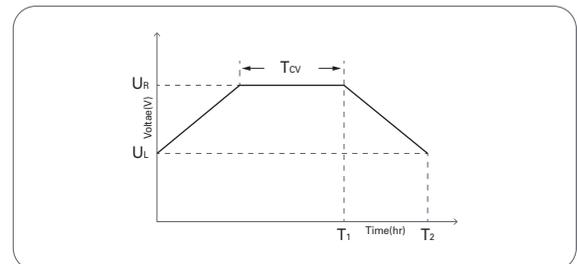
T₁ : time (s) from discharge start to reach U_R

T₂ : time (s) from discharge start to reach U_L

T_{cy} : Constant Voltage charging time: 30min

U_L : Rated lower limit voltage (V), U₂ at equation

U_R : Rated voltage (V), U₁ at equation



* Module specification for 2 series cells has identical characteristics to above items.
 * All test data in this catalogue follow IEC guidelines and VINATech use 25°C for all tests unless otherwise stated.
 * Visit our Web site for our new Capacitor Calculator.
 * Please contact us hycap@vina.co.kr, if you need detailed informations about product or customization.



SUPERCAPACITORS

SINGLE CELL / LEAD TERMINAL TYPE

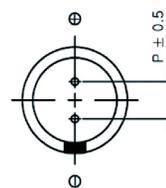
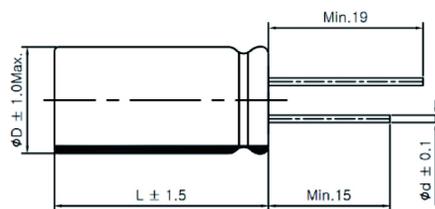
VINATech development engineers have developed the EDLC technologies in both 2.7 V and 3.0 V radial series to overcome the increasing challenges facing customers when finished products are installed in extreme conditions in areas of high temperature and high humidity. The challenging conditions are over and above recommended specifications for standard EDLCs.

Features

- High Power Density
- Over 500,000 cycle life
- RoHS/WEEE/REACH compliant
- Long - term reliability improved for extreme condition
- Peak Power Support / Backup Power Support



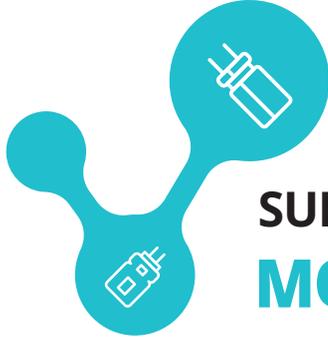
Drawing



D (Ø)	8	10	13	16	18
d (Ø)	0.6			0.8	
P (mm)	3.5	5.0	7.5		

Part Number	Rated Voltage	Capacitance (F)	ESR (mΩ)		Max. Current (A)	Leakage Current (mA, 72 hr)		Size (mm) D x L	Weight (g)	Volume (ml)
	(V _R)		AC (1 kHz)	DC		(@ 2.7 V)	(@ 3.0 V)			
WEC3R0105QG	3.0	1	145	215	1.2	0.002	0.003	08 x 13	1.1	0.7
WEC3R0335QG		3.3	75	125	3.5	0.007	0.010	08 x 20	1.5	1.0
WEC3R0505QD		5	50	85	5.0	0.010	0.015	08 x 25	1.8	1.3
WEC3R0505QG		5	80	120	4.5	0.010	0.015	10 x 20	2.1	1.6
WEC3R0705QD		7	45	75	6.5	0.014	0.021	08 x 30	2.2	1.5
WEC3R0705QG		7	80	135	5.0	0.014	0.021	10 x 20	2.2	1.6
WEC3R0106QA		10	45	75	8.5	0.020	0.030	10 x 25	2.6	2.0
WEC3R0106QG		10	30	45	10.0	0.020	0.030	10 x 30	3.2	2.4
WEC3R0106QD		10	50	75	8.5	0.020	0.030	13 x 20	3.4	2.7
WEC3R0126QD		12	30	50	11.0	0.024	0.036	10 x 30	2.9	2.4
WEC3R0156QG		15	37	55	12.0	0.030	0.045	13 x 25	4.5	3.3
WEC3R0186QC		18	30	50	14.0	0.036	0.054	13 x 25	4.8	3.3
WEC3R0256QG		25	20	30	21.0	0.050	0.075	16 x 25	7.2	5.0
WEC3R0506QG		50	13	20	37.0	0.100	0.150	18 x 40	12.5	10.2
WEC3R0606QG		60	13	20	40.0	0.120	0.180	18 x 40	13.5	10.2
WEC3R0107QD		100	12	20	50.0	0.200	0.300	18 x 59	17.5	15.0

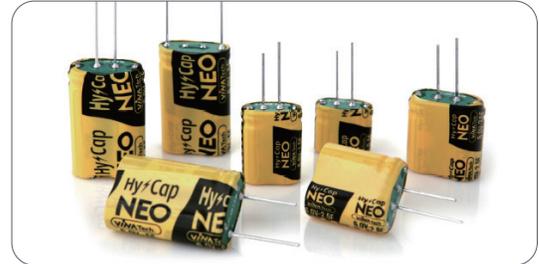
* Max. Current : 1 sec. discharge to 1/2 V_R
 * Connecting a module more than 2 series, please fully discharge over 1 hour first, then assemble right after within 1 hour
 * Taping versions available for volume orders 8 mm, 10 mm & 13 mm diameter products Also pre bending available
 * Please contact us hycap@vina.co.kr, if you need detailed informations about product or customization.



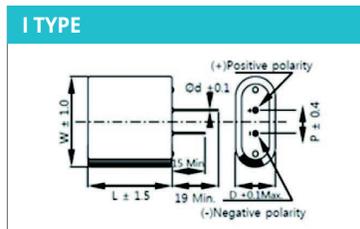
SUPERCAPACITORS MODULE IN 2 SERIES

Features

- High Power Density
- Over 500,000 cycle life
- 2 units serially connected to provide products
- RoHS/WEEE/REACH compliant
- Long term reliability improved for extreme condition
- Peak Power Support / Backup Power Support

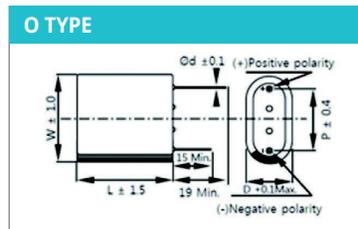


Drawing



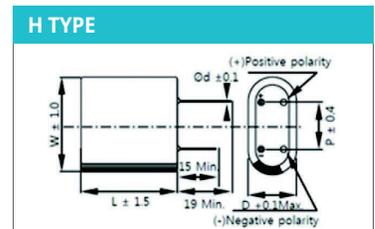
D = 8.5 mm, d = 0.6 mm

Type	I	O	H
P	4.5	12.9	8.5



D = 10.5 mm, d = 0.6 mm

Type	I	O	H
P	5.0	16.5	10.5



D = 13.5 mm, d = 0.6 mm

Type	I	O	H
P	7.5	18.5	13

D = 16.5 mm, d = 0.8 mm

Type	I	O	H
P	8.5	24.5	16.5

Item	Characteristic	
Product series	EDLC Module (2 Serial)	
Rated Voltage (V _R)	6.0 V	
Operating Temperature	-40°C ~ +65 °C (85 °C when de-rated)	
Capacitance Tolerance	-10 % ~ +30 %	
High Temp. Load Life	After 1,000 hours at V _R loaded under +65 °C, capacitor meet the following criteria.	
	Capacitance Change	≤ 30 % of initial value
	ESR	≤ 2 times of specified value
Cycle Life Characteristics	Cycle	Over 500,000
	ΔC	≤ 30 % of initial value
	ESR	≤ 2 times of specified value
	Method	Cycle of Charge/discharge from V _R to 1/2 V _R
Shelf life	3 years No Electrical Charge & Temp. below 25 °C (ΔC : ≤ 10 % of initial value / ΔESR : ≤ 50 % of specified value)	

Part Number	Rated Voltage	Capacitance (F)	ESR (mΩ)		Max. Current (A)	Leakage Current (mA, 72 hr)		Size (mm) D x W x L	Weight (g)	Volume (ml)
	(V _R)		AC (1 kHz)	DC		(@ 5.4 V)	(@ 6.0 V)			
WEC6R0504QG	6.0	0.5	295	435	1.2	0.002	0.003	8.5 x 17 x 15.5	2.5	2.2
WEC6R0155QG		1.5	175	295	3.5	0.007	0.010	8.5 x 17 x 22	3.3	2.8
WEC6R0255QG		2.5	165	245	4.5	0.010	0.015	10.5 x 21 x 22.5	4.7	4.4
WEC6R0355QG		3.5	165	275	5.5	0.014	0.021	10.5 x 21 x 22.5	4.7	4.4
WEC6R0505QA		5.0	95	155	8.5	0.020	0.030	10.5 x 21 x 27	6.6	6.3
WEC6R0505QG		5.0	65	95	10.0	0.020	0.030	10.5 x 21 x 32	6.6	7.1
WEC6R0755QG		7.5	79	115	12.0	0.030	0.045	13 x 26 x 28	9.6	9.5
WEC6R0126QG		12.5	45	65	21.0	0.050	0.075	16.5 x 32.5 x 28	17.2	17.7

- * Max Current : 1sec. discharge to 1/2 V_R
- * When connecting more than 2 series, please fully discharge over 1 hour first, then assemble right after within 1 hour
- * For 3 Series (9V) modules, contact the sales office
- * Please contact us hycap@vina.co.kr, if you need detailed informations about product or customization.



SUPERCAPACITORS

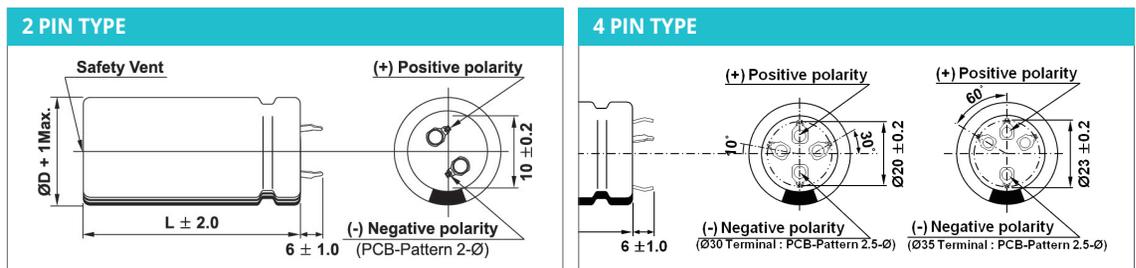
SINGLE CELL / SNAP-IN TYPE

Features

- High Power Density with Low ESR
- Over 500,000 cycle life
- RoHS/WEEE/REACH compliant
- Peak Power Support / Backup Power Support



Drawing



D (Ø)	22	25	35		
P (mm)	45	70	62	72	82

Item	Characteristic	
Product series	EDLC	
Rated Voltage (V _R)	3.0 V	
Operating Temperature	-40 °C ~ +65 °C (85 °C when de - rated)	
Capacitance Tolerance	-10 % ~ +30 %	
High Temp. Load Life	After 1,000 hours at V _R loaded under + 65 °C, capacitor meet the following criteria.	
	Capacitance Change	≤ 30 % of initial value
	ESR	≤ 2 times of specified value
Cycle Life Characteristics	Cycle	Over 500,000
	ΔC	≤ 30 % of initial value
	ESR	≤ 2 times of specified value
	Method	Cycle of Charge/discharge from V _R to 1/2 V _R
Shelf life	3 years No Electrical Charge & Temp. below 25 °C (ΔC : ≤ 10 % of initial value / ΔESR : ≤ 50 % of specified value)	

Part Number #1	Rated Voltage	Capacitance (F)	ESR (mΩ)		Max. Current #2 (A)	Leakage Current (mA, 72 hr)	Size (mm)	Weight (g)	Volume (ml)
	(V _R)		AC (1 kHz)	DC			D × L		
VEC3R0107QG	3.0	100	6.0	9.0	78	0.300	22 x 45	20.0	17.1
VEC3R0227QG		220	5.0	7.5	125	0.660	25 x 70	38.0	34.3
VEC3R0367QG		360	3.0	3.2	250	1.080	35 x 62	70.0	59.6
VEC3R0387QG		380	3.0	3.2	257	1.140	35 x 62	70.0	59.6
VEC3R0407QG		400	3.0	3.2	263	1.200	35 x 72	80.0	69.2
VEC3R0507QG		500	3.0	3.2	288	1.500	35 x 82	96.0	78.9
VEC3R0367QG		360	2.0	2.5	250	1.080	35 x 62	70.0	59.6
VEC3R0507QG		500	2.0	2.5	290	1.500	35 x 82	96.0	78.9

#1 Can be Customized
 #2 Max. Current : 1 sec. discharge to 1/2V_R
 * Please contact us hycap@vina.co.kr, if you need detailed informations about product or customization.



SUPERCAPACITORS

VET TO COMBAT EXTREME CONDITIONS UNDER DEVELOPMENT (Samples Available)

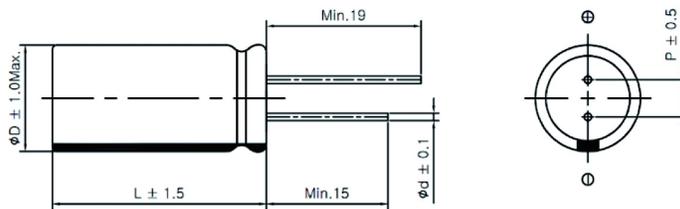
The limitation to higher temperatures has in the past been the Electrolyte used by Supercapacitor Manufacturers but now the R&D Team at VINATech have developed a new supercapacitor solution of NEO VET Series which will be particularly ideal for all IoT and AMI applications.

Features

- VET series of +85°C Single cell 2.7 V Supercapacitor
- Over 500,000 cycle life
- RoHS/WEEE/REACH compliant
- High Power Density
- Long-term reliability improved at high temperature 85°C and humidity of 85% RH
- Peak Power Support / Backup Power Support
- AEC-Q200 Qualified.



Drawing



D (Ø)	8	10
L (mm)	30	25
d (Ø)	0.7	
P (mm)	3.5	5.0

Item	Characteristic	
Rated Voltage (V_R)	2.7 V	
Operating Temperature	-40 °C ~ +85 °C	
Capacitance Tolerance	-10 % ~ +30 %	
High Temperature & High Humidity Load Life	After 1,000 hours at V_R loaded under +85°C, capacitor meet the following criteria.	
	Capacitance Change	≤ 30 % of initial value
	ESR	≤ 3 times of specified value
Cycle Life Characteristics	Cycle	Over 500,000
	ΔC	≤ 30 % of initial value
	ESR	≤ 3 times of specified value
	Method	Cycle of Charge/discharge from V_R to $1/2 V_R$
Shelf life	3 Years No Electrical Charge, Temperature below 25°C (ΔC : ≤ 10% of initial value / ΔESR : ≤ 100% of specified value)	

* Max. Current : 1 sec. discharge to $1/2 V_R$

* Note : The products are tested based on the test conditions and methods defined

Part Number	Rated Voltage (V_R)	Rated Capacitance (F)	ESRAC (mΩ)	3ESRDC (mΩ)	Max Current (A)	Leakage Current (mA)	Size (mm)	Weight (g)
	Surge Voltage (3.0 V)	@ 25 °C	@ 25 °C 1 kHz	@ 25 °C 10 msec	@ 25 °C	@ 25 °C	D × L	
VET08302R7605G	2.7	6	60	90	5.0	20	08 x 30	2.2
VET10252R7106G	2.7	10	45	75	7.7	30	10 x 25	2.6

* Regarding purchasing modules, please contact hycap@vina.co.kr.

* Please contact us hycap@vina.co.kr, if you need detailed informations about product or for automotive applications.



SUPERCAPACITORS

VPC VINA PULSE CAPACITOR

The new powerful VPC series offers high energy density, high power density, ultra-low leakage current, and low ESR.

VINATech has responded to market requests with 30F capacitance in 08 x 20 size. 100F, 150F, and 250F family products are also available.

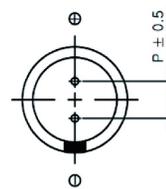
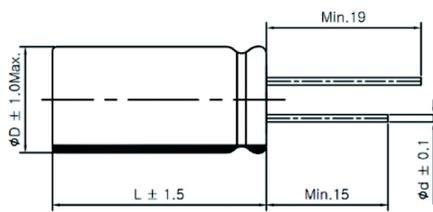
It is ideally suited to supporting battery-powered products and IoT applications.

Features

- Ultra Low Self Discharge
- High Operating Voltage
- High Energy Density
- High Capacitance
- Wide Operating Temperature Range



Drawing



D (Ø)	8	8	10	13	13
L (mm)	20	25	30	25	35
d (Ø)	0.8				
P (mm)	3.5	3.5	5.0		

Item	Spec. value	Test methods
Operating Voltage Range	2.5 V to 3.8 V	
Operating Temp. Range	-25 °C ~ 70 °C	
Load Life @ 70 °C		- Temperature : 70 ± 2°C - Time : 1,000 hours - Voltage : 3.8V
Heat cycle characteristics	Capacitance : ≤ 30 % of initial value ESR : ≤ 2 times of specified value Appearance : No abnormality	- Temperature : 70 ± 2 °C, -40 ± 2 °C - Duration : 30 min - Cycle Numbers : 100 cycles
Cycle Life		- Temperature : 25 ± 2 °C - Cycle Number : 20,000 - Discharge Current : 20 C - rate - Cut-off Voltage : 2.5 V (DOD 100 %)
Low Temperature characteristics	Capacitance : ≤ 50 % of initial value ESR : Less than 20 times of specified spec.	The specification shall be met lower category temperature range of -25 °C

#1 Reference IEC62813 4.2
#2 1sec. Discharge to 3.2V

Part Number	Capacitance #1 (FV ₂)	Capacity (mAh)	ESR (mΩ)		Leakage Current (μA)	Rated Current (A)	Pulse Discharge Current (A)	Pulse Charge Current (A)	Max Charge Volt #3 (V)	Weight (g)
			AC	DC						
			@ 25 °C 1kHz	@ 25 °C						
VEL08203R8306G	30	11	350	700	1	0.1	0.5	0.6	3.85	1.9±0.2
VEL08253R8506G	50	18	210	500	1	0.15	0.5	1.0	3.85	2.5±0.2
VEL10303R8107G	100	36	100	200	5	0.4	2.0	3.0	3.85	4.4±0.3
VEL13253R8157G	150	54	70	140	7	0.5	3.0	5.0	3.85	6.2±0.3
VEL13353R8257G	250	90	50	100	10	0.75	5.0	8.0	3.85	8.2±0.3

#1 Reference IEC62813 4.2
#2 1sec. Discharge to 3.2V
#3 If the charging voltage is continuously used at 3.85V, the lifespan is reduced by 10%
* Please contact us hycap@vina.co.kr, if you need detailed informations about product or customization.



SUPERCAPACITORS

POUCH CELL SUPERCAPACITORS UNDER DEVELOPMENT (Samples Available)

VPC Pouch Cell / Large Size

Part number	Rated Voltage (V)	Capacitance (F)	Size(mm) D X L	Thickness (mm)	DC-ESR (mΩ)	Max. Current (A)
VPC3R8259-P	3.8V	25,000F	122 x 136	18.0 Max	< 0.6	180
VPC3R8129-9	3.8V	12,000F	122 x 136	10.0 Max	< 1.2	88
VPC3R8608-P	3.8V	6,000F	122 x 136	5.0 Max	< 2.4	44

VPC Pouch Cell / Small Size

Part number	Rated Voltage (V)	Capacitance (F)	Size(mm) D X L	Thickness (mm)	DC-ESR (mΩ)	Max. Current (A)
VPC3R8807-P	3.8V	800F	45 x 58	5.0 Max	< 75	3
VPC3R8407-P	3.8V	400F	45 x 58	3.0 Max	< 150	1.5
VPC3R8157-P	3.8V	150F	28 x 23	5.0 Max	< 400	0.58

LIC Pouch Cell

Part number	Rated Voltage (V)	Capacitance (F)	Size(mm) D X L	Thickness (mm)	DC-ESR (mΩ)	Max. Current (A)
Not fixed	3.8V	3,200F	122 x 136	18.0 Max	< 1.0	142



SUPERCAPACITORS USER GUIDANCE

01

Do not take the product apart or damage at random. Follow guidelines for product placement (Soldering, pin formation etc.) Warranty will not be granted if there has been failure to follow our guidelines.

02

Polarity

+ This is a polarised product (+positive and -negative poles) so it must be used accordingly. The negative pole is clearly marked on the product sleeve.

03

Overvoltage and overcurrent

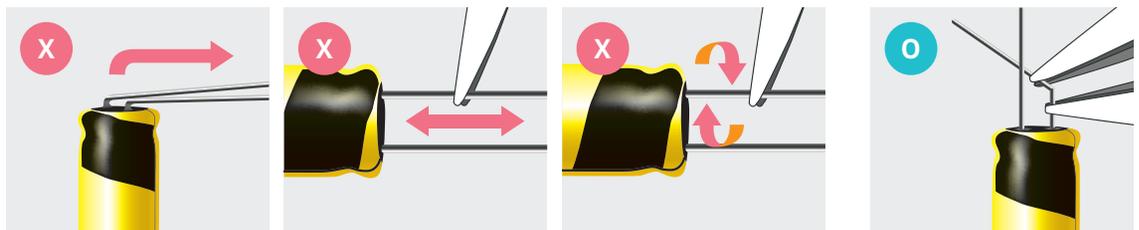
- + It is recommended that the product should be used below the rated voltage. When used over the rated voltage, it could lead to vent expansion and failure, the useful life span will be shortened.
- + In case of connecting more than 2 units for modules, we recommend lowering the operating voltage per cell by a minimum of 10 % from the rated voltage to ensure safer voltage balancing (e.g. 2.43 V per unit in case of 2.7 V series).
- + It is recommended that the product should be applied below the maximum current. When used above the maximum current, it will lead to can expansion and failure or its life span will be shortened.

04

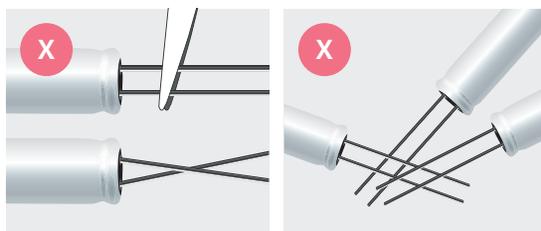
Working conditions and storage

- + The working life of this product will be shortened by the working environmental conditions, such as temperature, humidity and air pressure among others.
- + Do keep the product within environmental conditions that are recommended in this document. Check with the sales office.
- + Do not expose the product to over 75 % relative humidity. When exposed for a long time, its life can be shortened or it can cause malfunction.
- + Do not use or keep the product in the temperature range that is higher than recommended in this document. Its life will be shortened or it can cause malfunction.
- + Do not use or keep the product in highly corrosive atmospheres that is composed of substances (for example, the environment that is exposed to halogen substances, such as Cl, F, or halogen compounds, nitrogen substances or nitrogen compounds, sulphur substances or sulphur compounds, hexavalent chrome, arsenic, among others).

EDLC Lead Terminal Bending Process



VPC Handling Instructions



* Product head and fire may occur due to incorrect product storage, product measurement and processing.



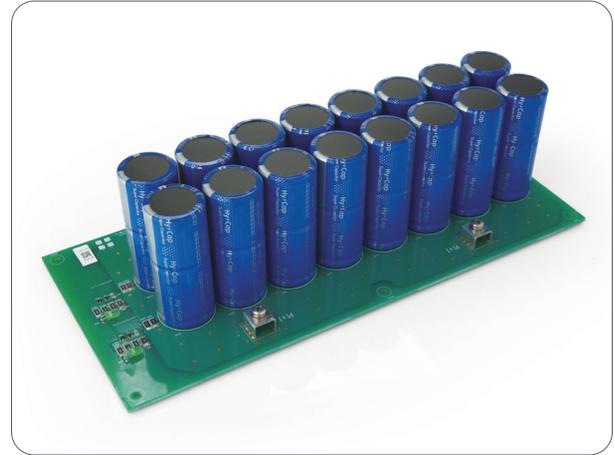
SUPERCAPACITORS MODULE CUSTOMIZED SERIES

Features

- Ultra - low internal resistance
- High - power and reliable performance
- Over 500,000 duty cycles
- Compact & fully enclosed splash proof design

Applications

- Automotive
- AGV/Robotics
- Consumer electronics
- Renewable energy system
- Short term UPS & Telecommunications
- Wind turbine pitch control



Item	Characteristic	
Product series	EDLC Customized Series Module	
Operating Temperature	-40 °C ~ +65 °C (85 °C when derated)	
Capacitance Tolerance	-10 % ~ +30 %	
High Temp. Load Life	After 1,000 hours at V_R loaded under +65 °C, capacitor meet the following criteria.	
	Capacitance Change	≤ 30 % of initial value
	ESR	≤ 2 times of specified value
Cycle Life Characteristics	Cycle	Over 500,000
	ΔC	≤ 30 % of initial value
	ESR	≤ 2 times of specified value
	Method	Cycle of Charge/discharge from V_R to 1/2 V_R
Shelf life	3 years No Electrical Charge & Temp. below 25°C (ΔC : ≤ 10 % of initial value / ΔESR : ≤ 50 % of specified value)	

Part Number	Rated voltage (V)	Capacitance (F)	DCESR (mΩ)	Cell Structure	Size(mm) (W x L x H)	Weight (kg)	Energy density (Wh/kg)	Power density (W/kg)
VEM30R0366QG	30	36	55	3.0V - 360F 10S	122 x 150 x 70	0.85	5.3	2,310
VEM30R0106QG	30	10	95	3.0V - 100F 10S	160 x 60 x 50	0.35	3.6	3,248
VEM60R0505QG	60	5	180	3.0V - 100F 20S	146 x 104 x 70	0.45	5.6	5,333
VEM18R0606QG	18	60	20	3.0V - 360F 6S	37 x 233 x 70	0.67	3.2	2,293
VEM144R0755QG	144	7.5	165	3.0V - 360F 48S	315 x 340 x 70	4	5.4	3,770
VEM18R0127QG	18	120	19	3.0V - 360F 6S2P	270 x 100 x 70	1	5.4	2,046
VEM90R0166QG	90	16.6	145	3.0V - 500F 30S	400 x 200 x 90	3.5	5.3	1,915
VEM60R0256QG	60	25	100	3.0V - 500F, 20S	230 x 153.5 x 90	2.5	5	2,468

* Please contact us hycap@vina.co.kr, if you need detailed informations about product or customization.



Power Solution Division_Module & pack

Expanding Value Chain, Diversifying Applications

Cell



Module



System

Cell



Module & System

Hybrid-CAP Standardized Module

(Usability, Expandability, Advanced Innovation)



Business



Logistics

Expanding markets and diversifying applications due to changing industrial trends



OHT



AGV



Rack Master



Pallet Shuttle



Energy



FR-ESS



UPS / D.Center



Renewable



Voltage-sag



Mobility



FE-CAR



TRAM



Golf-Car



Drone



Module



DATA Center



E-Latch



Standard M/D



Automotive



Military



Warship



Military Truck



Self-Propellent Artillery (K9)



Tank



IT Com. Health



Towers/Satellite



Base station (UPS)



Medical (MRI)



Portable (AED)

FUEL CELL COMPONENT

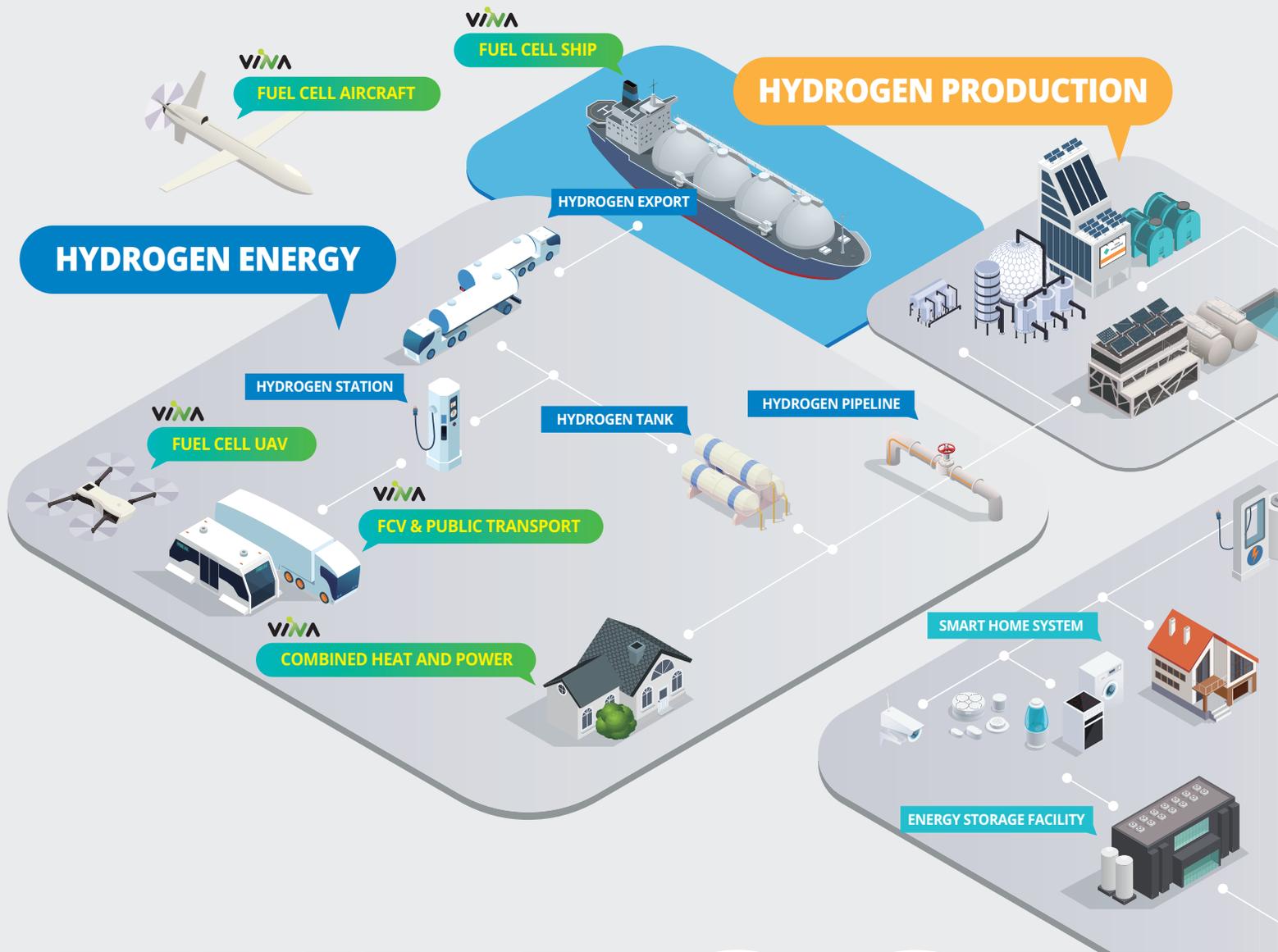


World's Leading Manufacturer of Supercapacitors and Fuel Cell Components

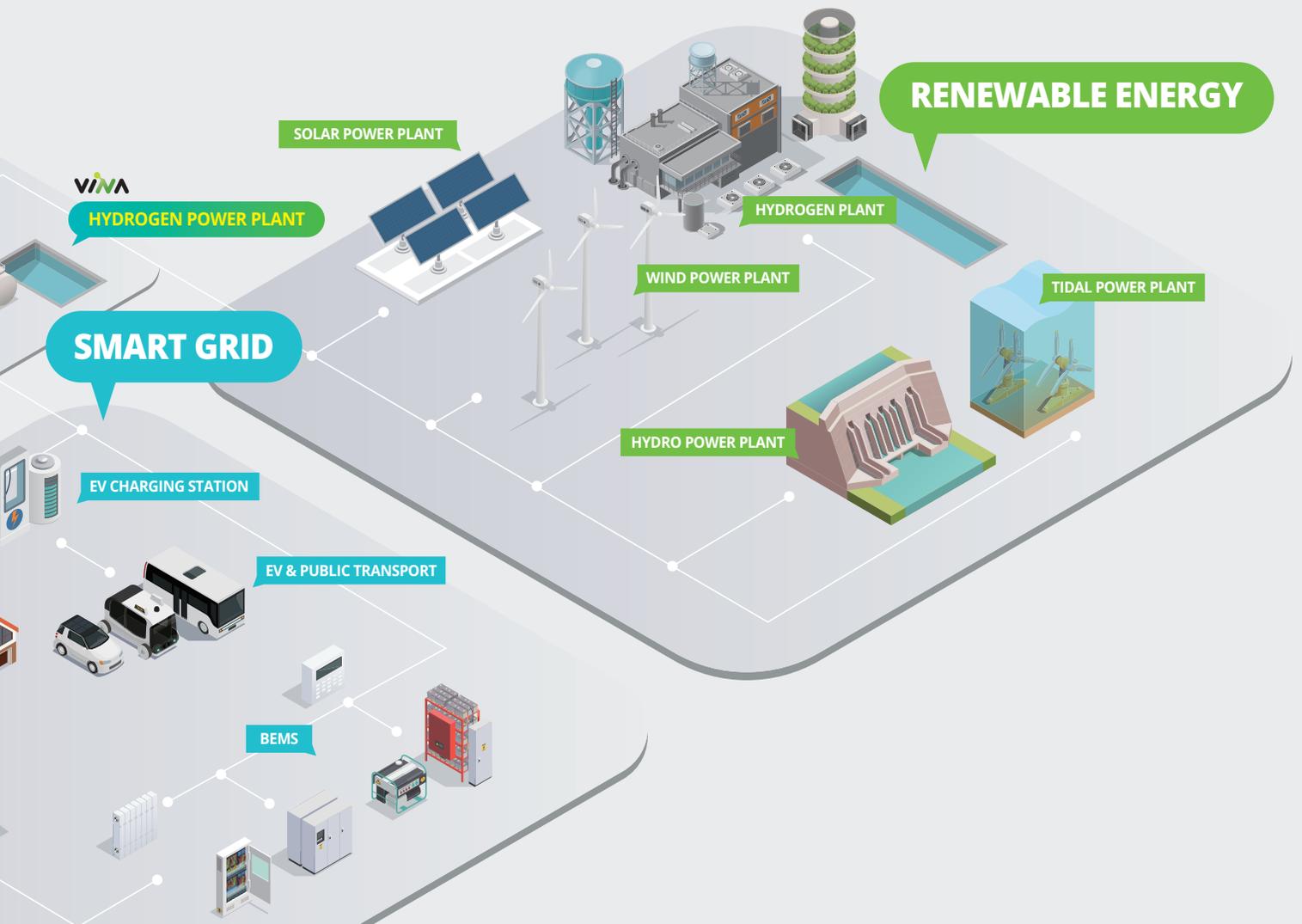
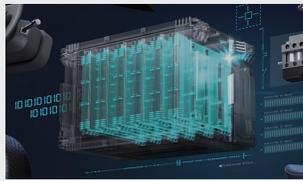


FUEL CELL COMPONENTS HYDROGEN ECONOMY

The term “hydrogen economy” means a vision to replace hydrogen, a low-carbon energy source, with transport fuels and natural gas for heating. Countries around the world are trying to cope with global weather changes by realizing the hydrogen economy. Hydrogen is produced by reforming ammonia, methane, etc., which are easy to transport, or by water electrolysis using renewable energy such as wind and solar power generation. The fuel cell is a core part of “Hydrogen energy”, which is using for generating energy. The fuel cell generates electricity through hydrogen and oxygen chemical reactions and occurs heat and water during power generation.



HYDROGEN



ECONOMY

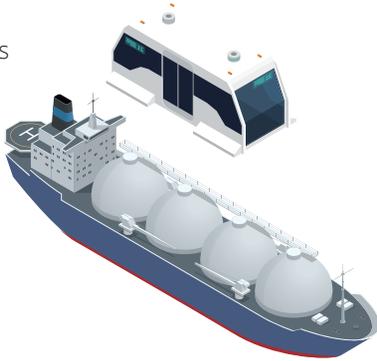


FUEL CELL COMPONENTS PRODUCT APPLICATIONS AREA



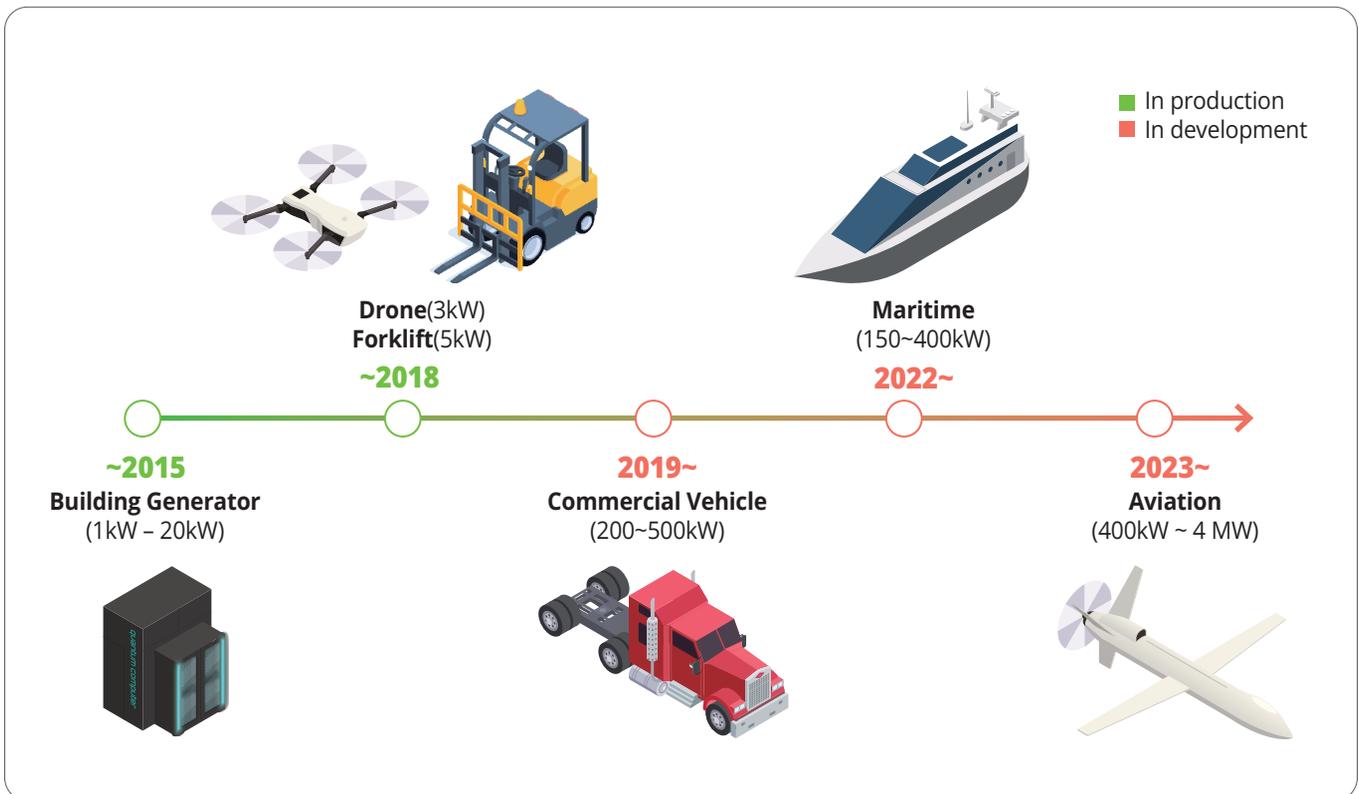
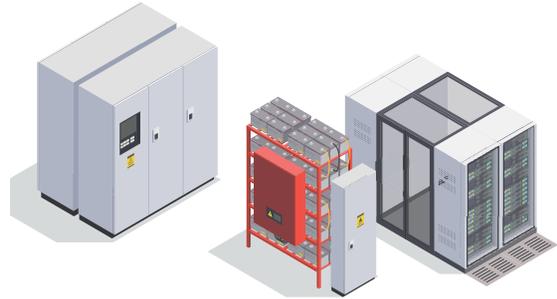
TRANSPORTATION

- Automotive
- Commercial vehicles
- Specialty vehicles
- Vessel
- Rail & Trams
- Heavy Equipment
- Drones
- Aviation
- Maritime



STATIONARY

- Combined heat and power (CHP)
- Primary power units
- UPS





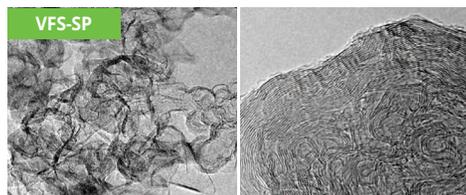
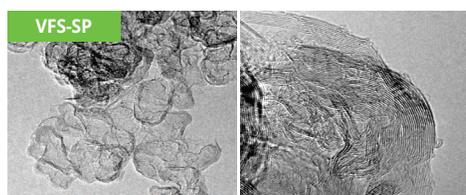
FUEL CELL COMPONENTS CARBON SUPPORT

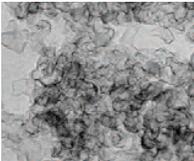
Sphere Carbon Black

- High mesopore ratio : suitable for PEMFC Electrochemical reaction
- High surface area and crystallinity : Highly stable for various conditions

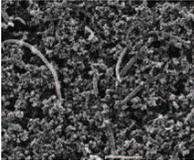
Part No.	BET (m ² /g)	XRD (d ₀₀₂ , nm)	XRD (LC ₀₀₂ , nm)
VFS-SP	400 - 800	0.345 - 0.355	1.5 - 3.5

- BET : Brunauer-Emmett-Teller 이론을 따르는 비표면적
- XRD(d₀₀₂) : X-Ray Diffraction, X선 회절에 의한 층간거리





High surface area



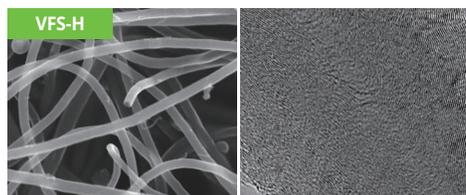
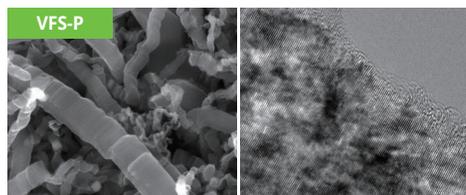
Hybrid technology

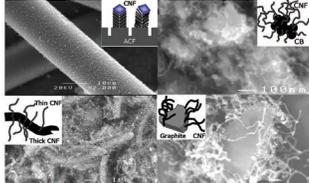
Carbon NanoFiber

- Uniform edge surface : high electrical conductivity
- High crystallinity : high durability

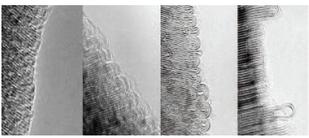
Part No.	Diameter (nm)	BET (m ² /g)	XRD (d ₀₀₂ , nm)
VFS-P	80 - 350	50 - 100	0.336 - 0.338
VFS-H	20 - 160	20 - 160	0.340 - 0.350

- Length of a fiber stand adjustable





Hybrid technology



Surface and Edge Control



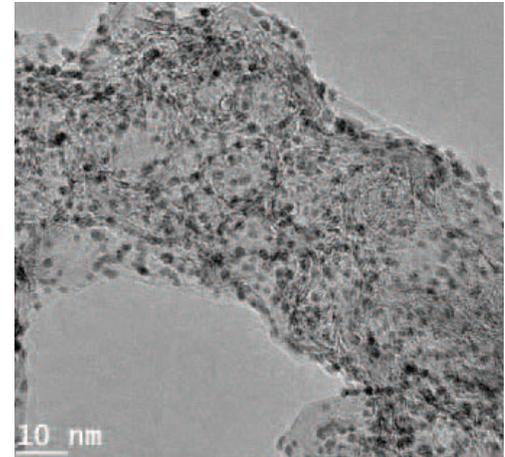
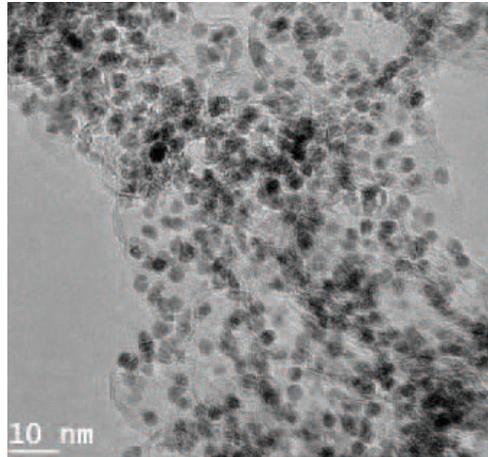
FUEL CELL COMPONENTS CATALYST

- High electrochemical surface area
- Maximizing platinum utilization
- Customized design available

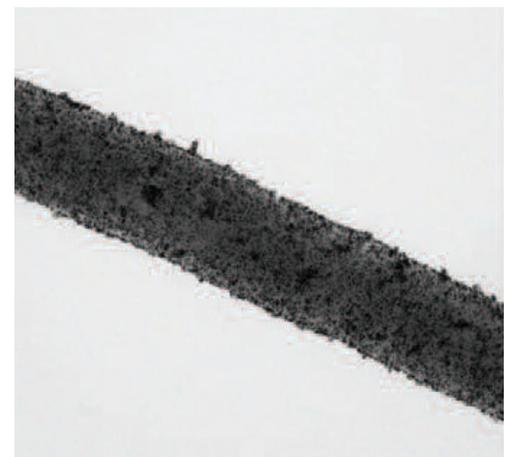
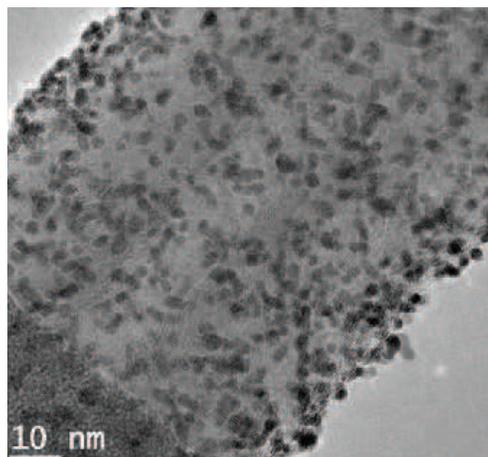


Division	Pt content (%)	ECSA (m ² /g)	Particle size (nm)	Support type
VFC-SP (Grade)	20 ~ 60	50 ~ 60	2.5 ~ 3.0	Carbon black
VFC-HE (Grade)		30 ~ 45	2.5 ~ 2.8	Herringbone

VFC-SP (Grade)



VFC-HE (Grade)





FUEL CELL COMPONENTS

MEA (Membrane Electrode Assembly)

PEMFC MEA (25 cm²) single-cell catalyst durability AST(Accelerated Stress Test) results show that VINATech's catalyst durability is better than competitor's.

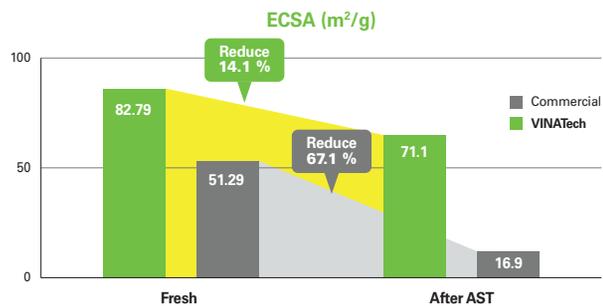
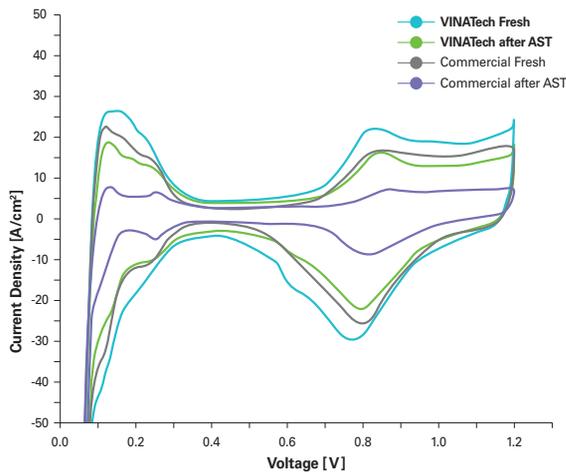
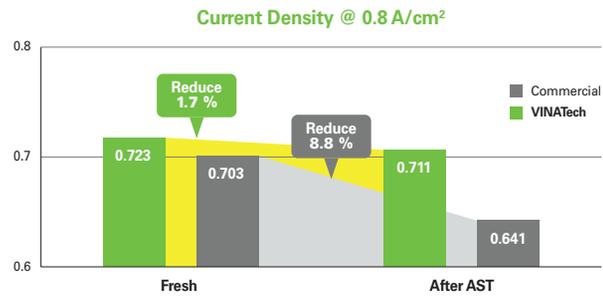
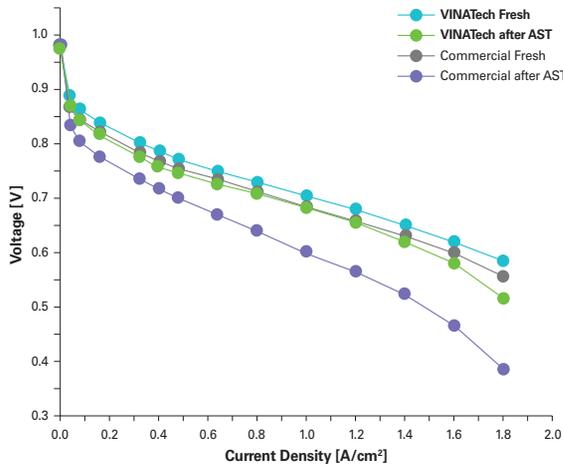
Carbon support Accelerated stress test in MEA

Electrochemical analysis MEA in single cell (25cm²)

(0.6 - 0.95 V 30 K Cycle)

I-V Test condition

- T Cell : 60 °C
- P Cell : An / Ca = 1 bara / 1 bara
- SR : H₂ / Air = x 1.5 / x 2.0
- RH : An = 100 %, Ca = 100 %





FUEL CELL COMPONENTS

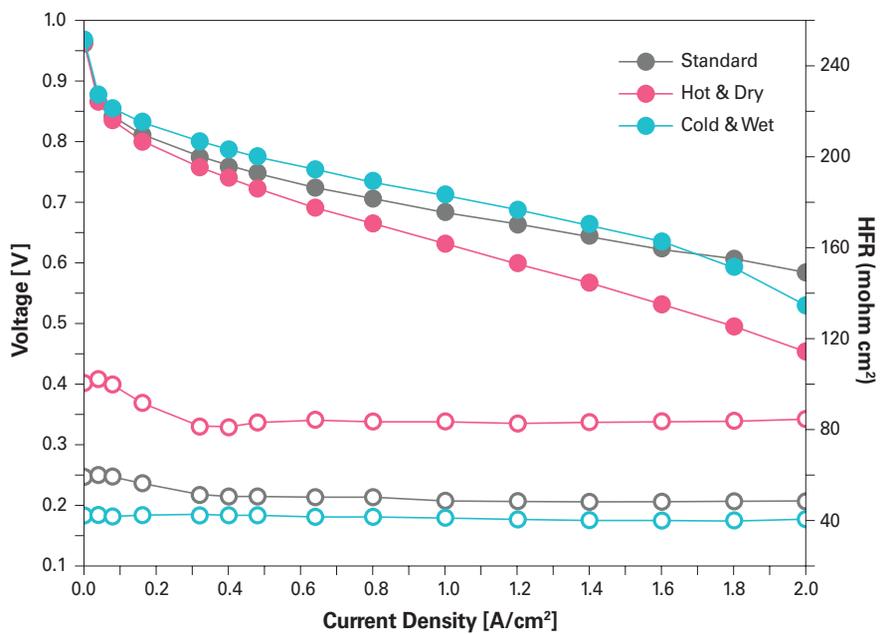
MEA (Membrane Electrode Assembly)

- Available to PEMFC & DMFC
- High reliability and durability
- High Stability in Various Environments
- Customized layer (3 to 9)
- Environmental Sensitivity



Sensitivity test

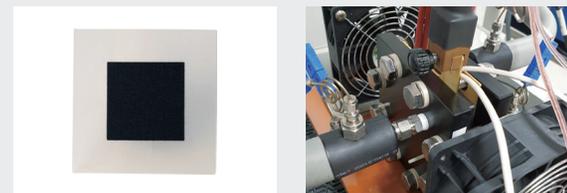
Electrochemical analysis MEA in single cell (25 cm²)



Test Condition

Division	T Cell (°C)	RH A/C (%)	P Cell (bara)	SR A/C (λ)
Std.	70 - 75	100/50	1	1.4/2.5
Hot&Dry	75 - 80	30/30	1	1.4/2.5
Cold&Wet	60 - 65	100/100	1	1.4/2.5

Test Sample



MEA 25 cm²

Single Cell test

MEA Specification

- 25 cm² Single cell

Division	mV @ 250 mA/cm ²	mV @ 500 mA/cm ²	mV @ 1,000 mA/cm ²	mV @ 1,500 mA/cm ²	mV @ 2,000 mA/cm ²
Standard	793	747	685	636	584
Hot & Dry	778	719	633	550	456
Cold & Wet	814	775	716	651	530



FUEL CELL COMPONENTS

MEA (Membrane Electrode Assembly)

PEMFC MEA (25 cm²) single-cell carbon corrosion AST (Accelerated Stress Test) results show that VINATech's carbon support durability is better than competitor's.

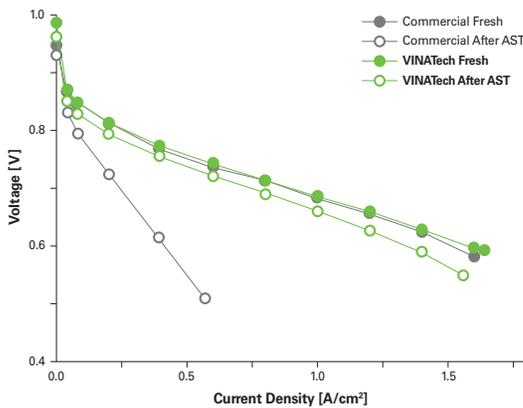
Carbon support Accelerated stress test in MEA

Electrochemical analysis MEA in single cell (25 cm²)

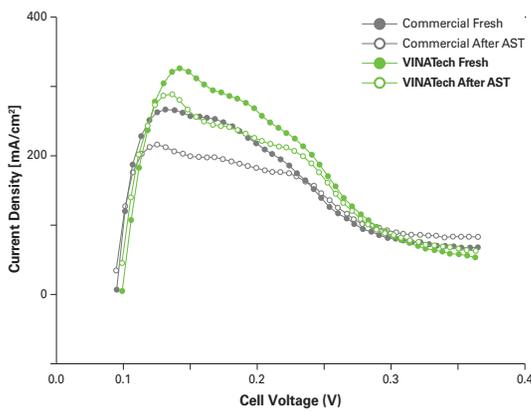
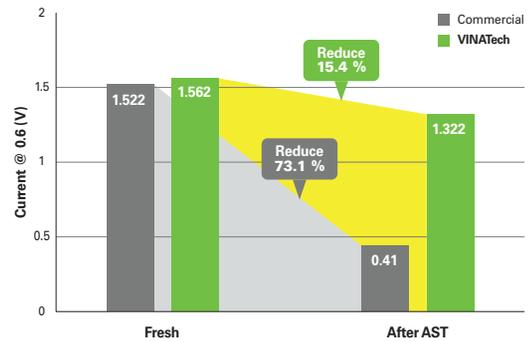
High voltage durability test (1.0 ~ 1.5 V, 500 mV/s, 5 k - 10 k cycling)

Test Condition

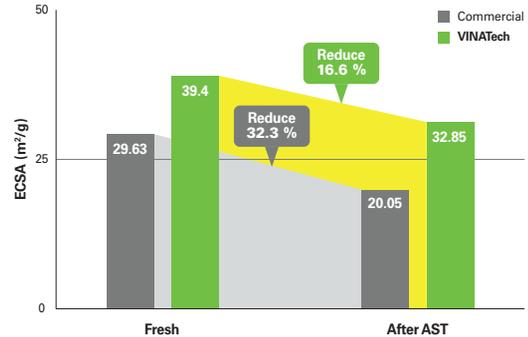
- T Cell : 60 °C
- P Cell : An / Ca = 1 bara / 1 bara
- Flow : H₂ / N₂ = 200 cc / 600 cc
- RH : An / Ca = 100 % / 100 %
- Cycle : 500 mV/s (1.0 - 1.5 V, 5 k cycling)



Current Density @ 0.6 V



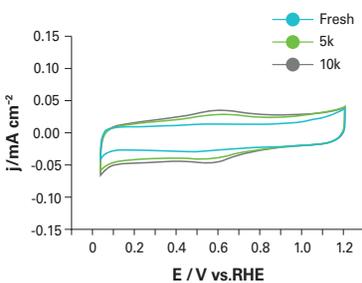
Electrochemical Surface Area (m²/g)



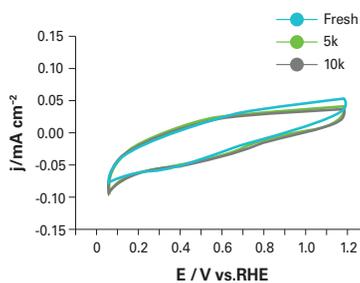
Carbon corrosion stability in Half cell

Accelerated Testing for Carbon Support (1.0 - 1.5 V, 500mV/s)

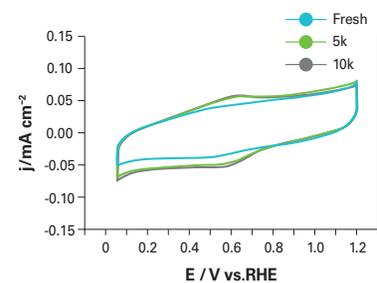
Other Company



Carbon Nanofibers



SP Carbon

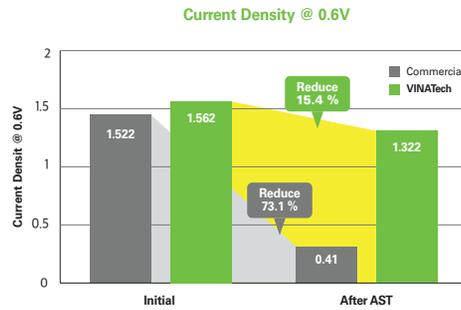
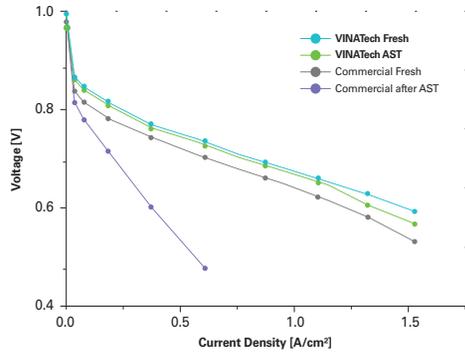




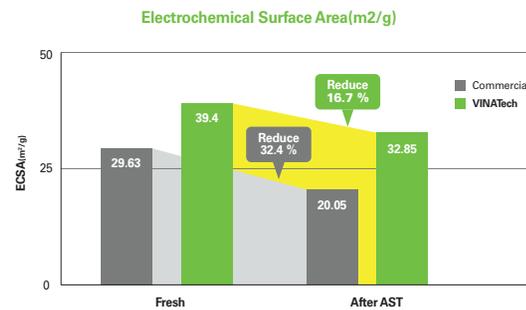
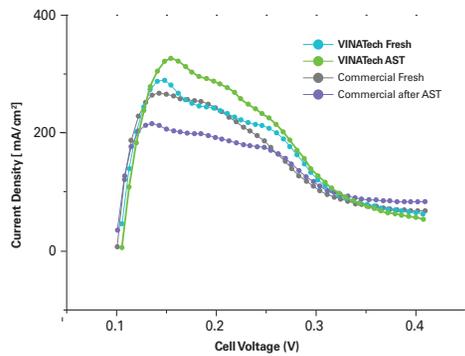
FUEL CELL COMPONENTS

MEA (Membrane Electrode Assembly)

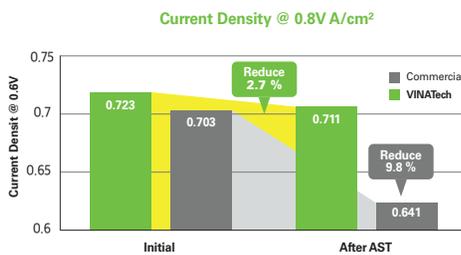
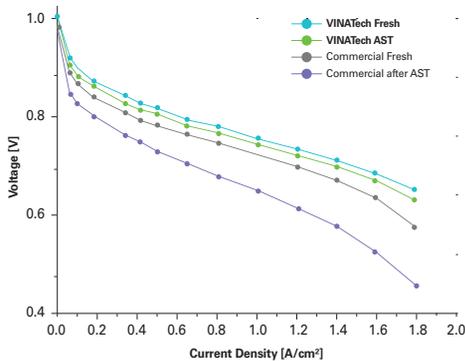
Carbon support Accelerated stress test in MEA



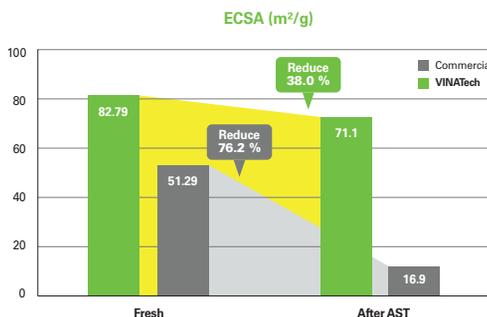
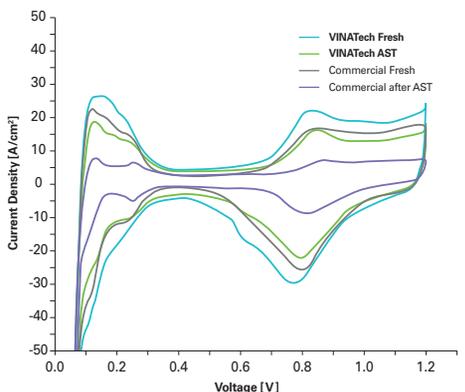
1.0-1.5 V, 500 mV/s, 5k - 10k Cycle



Electrocatalyst Accelerated Stress test in MEA



0.6 - 0.95 V 30k Cycle



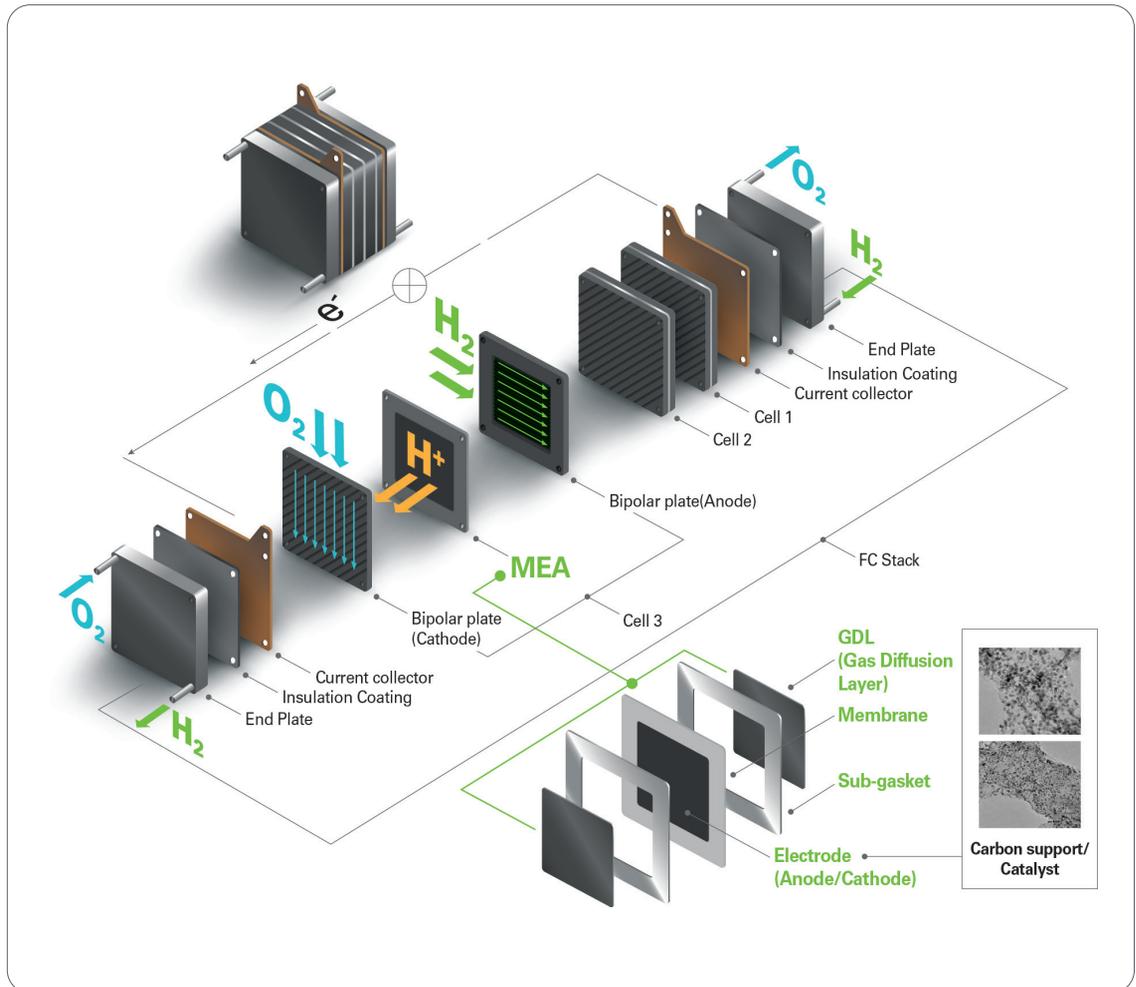


FUEL CELL COMPONENTS CUSTOMIZATION

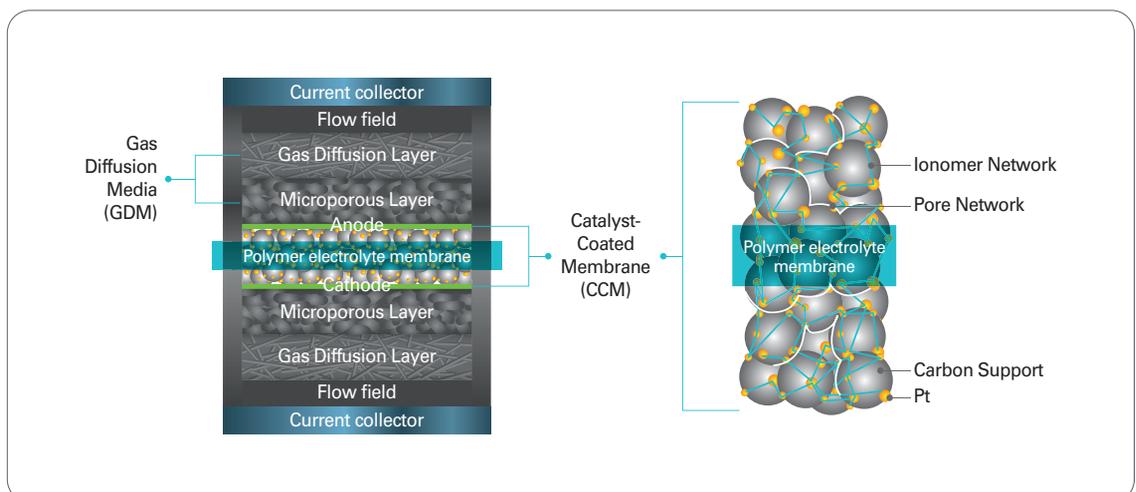
VINATech is the only Korean company that manufactures Carbon Supports, Catalysts, MEAs, and other core fuel cell materials and components.

All the fuel cell components produced by VINATech can be customized for different customer needs.

MEA/Single cell stack constructure



Optimum electrode structure



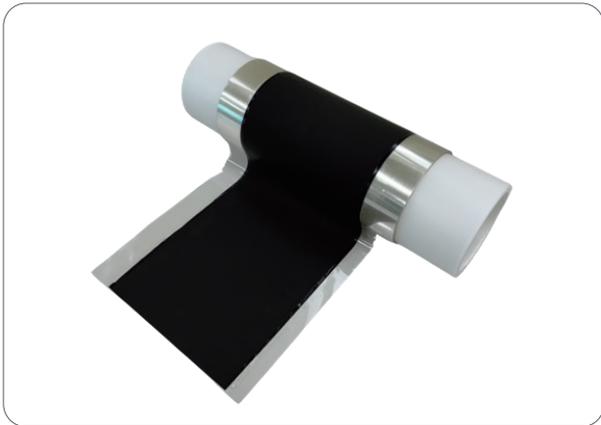


FUEL CELL COMPONENTS

MEA COATING TECHNOLOGY

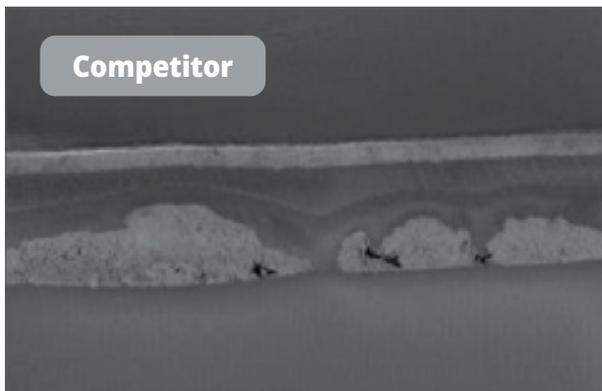
VINATech is the only company in Korea that manufactures core materials of carbon support, catalyst and MEA, mainly focusing on the production of fuel cell MEA based on its carbon composition technology. That is why VINATech can handle all about problem of carbon support to MEA, and easily find which part make some problem, Based on these technologies, VINATech can customize the optimized MEA what is fitted customers' needs.

- 01** A catalyst based on carbon support developed and validated over 20 years.
- 02** Mass production technology acquired through decades of experience with over 120 different types of production(3 to 9 Layers MEA)
- 03** **Direct to Membrane CCM production technology: A production technology achieved through research focusing on performance, durability, and cost, along with decades of production experience, resulting in a significant cost reduction compared to the traditional Decal method.**

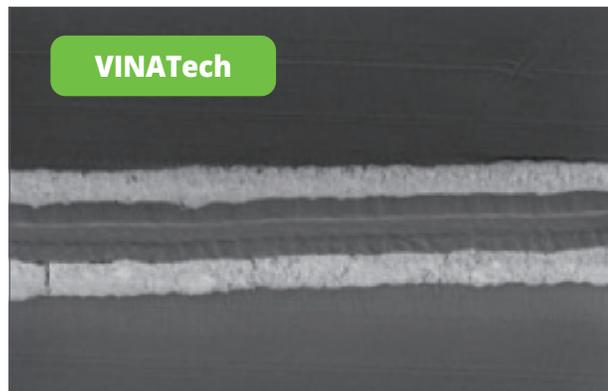


- World's first direct-coating technology for electrolyte membranes (double sided)

MEA Scanning Electron Microscope (SEM) Measurement result (500x)



Competitor



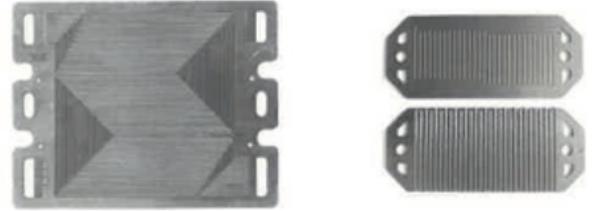
VINATech



FUEL CELL COMPONENTS

BIPOLAR PLATE (Carbon composite)

- Available to PEMFC
- Excellent electrical conductivity and durability
- Microflow and Thin-Plate Forming Technology

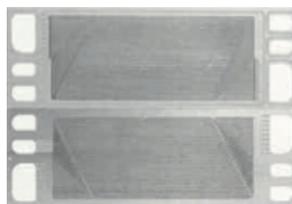
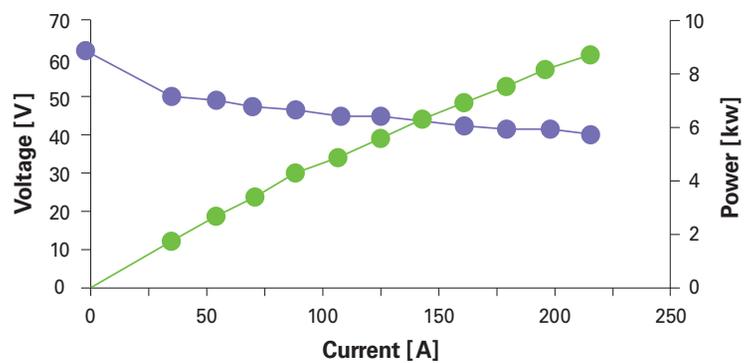


Product Specification

Physical Properties	Unit	D.O.E target (2025)	Technical ability	Measuring institution
Active Area	cm ²	-	20 - 200	Korea Automotive Technology Institute
Thickness	mm	-	1 - 3	Korea Automotive Technology Institute
Electric Conductivity	S/cm	≥ 100	161	Korea Automotive Technology Institute
Hydrogen Permeability	Std cm ² / sec. cm ² .Pa	<2x10 ⁻⁵	<2.01 x 10 ⁻¹⁰	Korea Automotive Technology Institute
Flexural Property	Mpa	>40	76.2	Korea Automotive Technology Institute
DC Corrosion	μA/cm ²	<1	0.85	Korea Automotive Technology Institute
Areal specific resistance	ohm·cm ²	<0.01	0.00935	Korea Automotive Technology Institute
Thermal conductivity	W/m-K	-	34	Kyungnam university

Test Sample

Stack Performance



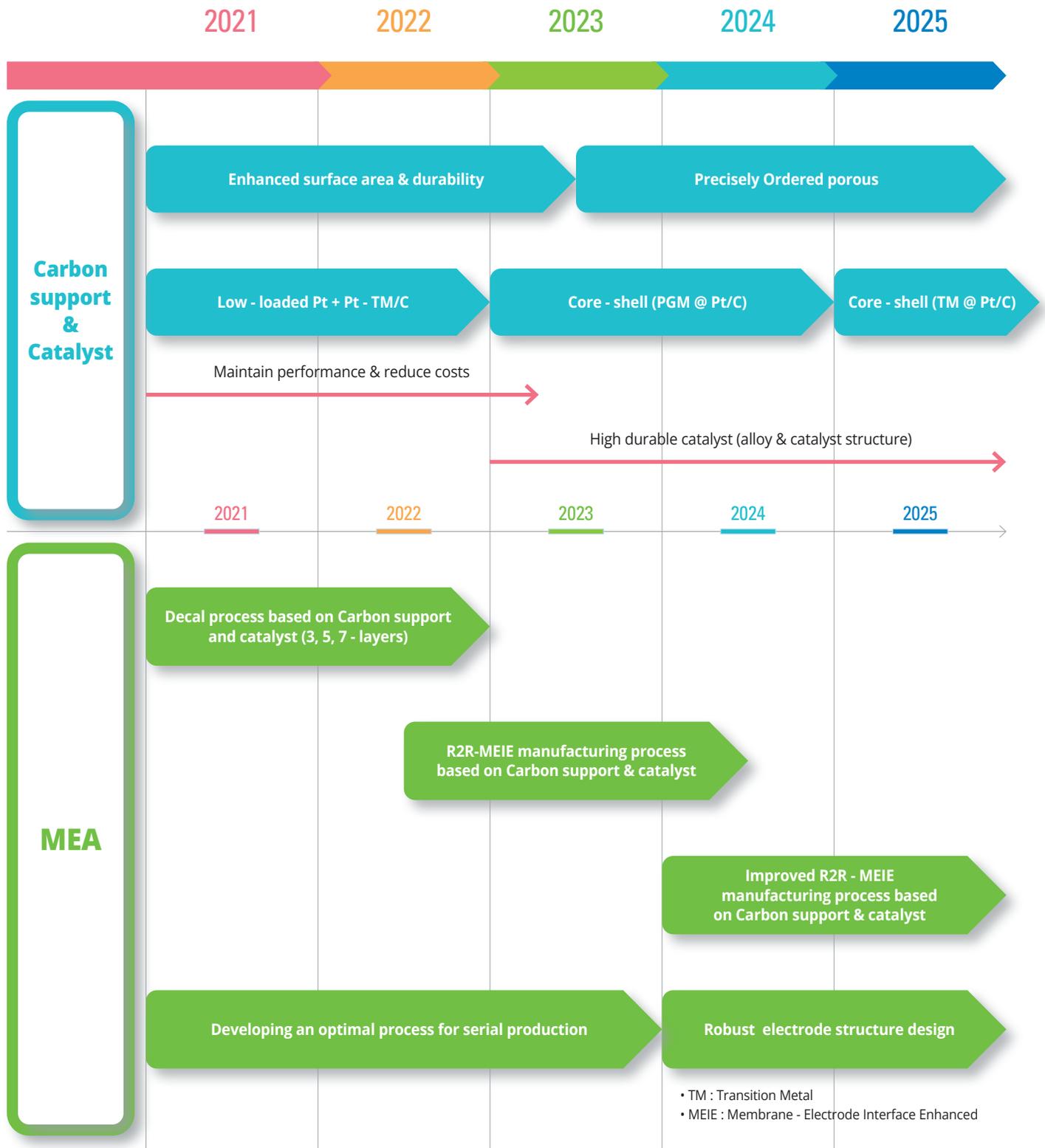
• Active area 180cm²



• 65 cell Stack test



Fuel Cell Component DEVELOPMENT ROADMAP



ABOUT VINATech



World's Leading Manufacturer of Supercapacitors and Fuel Cell Components



ABOUT VINATech

**World's Leading Manufacturer of Supercapacitors.
Comprehensive Producer of Fuel Cell Components.**

VINATech endeavour to fulfil the happiness of our customers, employees and shareholders as well as our society, by offering environmentally - friendly products.

VINATech is the leading supercapacitor manufacturer and provides the energy saving device including Hybrid Super Capacitor and Lithium Hybrid Capacitor. VINATech provides Fuel cell Component including Carbon support, Pt/C Catalyst, and Membrane Electrode Assembly (MEA) comprehensively with securing Carbon technology which VINATech have researched and developed for environmentally friendly future growth. It is applied as many as areas from Social Infrastructure for building Smart City to hydrogen fuel cell related area.

VINATech HISTORY

1999

START UP



1999 | Company Founded

2003 | Supercapacitor R&D started

2004 | Registered R&D center

2004 | Production of Supercapacitor started

2005

BUILD UP



2005 | Venture Company Grand Award

2006 | Selected as Promising Small Business Company

2008 | Best HRD Certification

2010 | 3V Supercapacitor Development

DISTRIBUTION & SUPERCAPACITOR BIZ.



R&D · MANUFACTURING TECHNOLOGY IMPROVEMENT



VINATech PROFILE

Company

VINATech Co., LTD.

Foundation

July 1999

Head office & Factory

15, Unam-ro, Deokjin-gu, Jeonju-si, Jeollabuk-do, Korea (postal code 54853)

Overseas Factory

Ha Lieu Hamlet, Phuong Lieu Commune, Que Vo District, Bac Ninh Province 16800

Main Business

- Supercapacitors
- Fuel Cell Components

2011 JUMP UP



- 2011** | Relocate Headquarters (Gunpo → Jeonju)
- 2012** | Selected Global Small & Strong Business
- 2012** | Grand Prize Small Business IP Manager
- 2013** | KONEX Stock Market IPO
- 2013** | Start Carbon Materials Business (Fuel Cell, Environment Filter)
- 2014** | Awarded for IP - R&D from Korea IP Office
- 2016** | Selected 'Global Small Giant Company' from Industry Ministry

ENERGY STORAGE DEVICE EXPERT COMPANY



2017 GROW UP



- 2017** | 'VINATech VINA' established in Bac Ninh, Vietnam
- 2018** | Vietnam Factory Start operation
- 2018** | R&D Center built in HQ
- 2019** | Leading SME Award by Government of South Korea
- 2020** | KOSDAQ Stock Market IPO
- 2020** | Acquired Acecreation (Bipolar Plate)
- 2021** | Wanju factory (55,000 m2) Groundbreaking Ceremony
- 2021** | Obtainment of Bipolar Plate Technology (Carbon Support Manufacturing Technology)
- 2022** | 2022 Selection of World First-class Products(Supercapacitor)
- 2023** | Selection of World First-class Products(MEA)

ENERGY STORAGE DEVICE LEADING COMPANY



VINA MISSION

Our mission is to create a harmonious and eco-friendly society by providing innovative and eco-friendly energy solutions.



**MEMBER
SATISFACTION**

**ECO-FRIENDLY
PRODUCTS**

**HARMONIOUS
COMMUNITY**



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