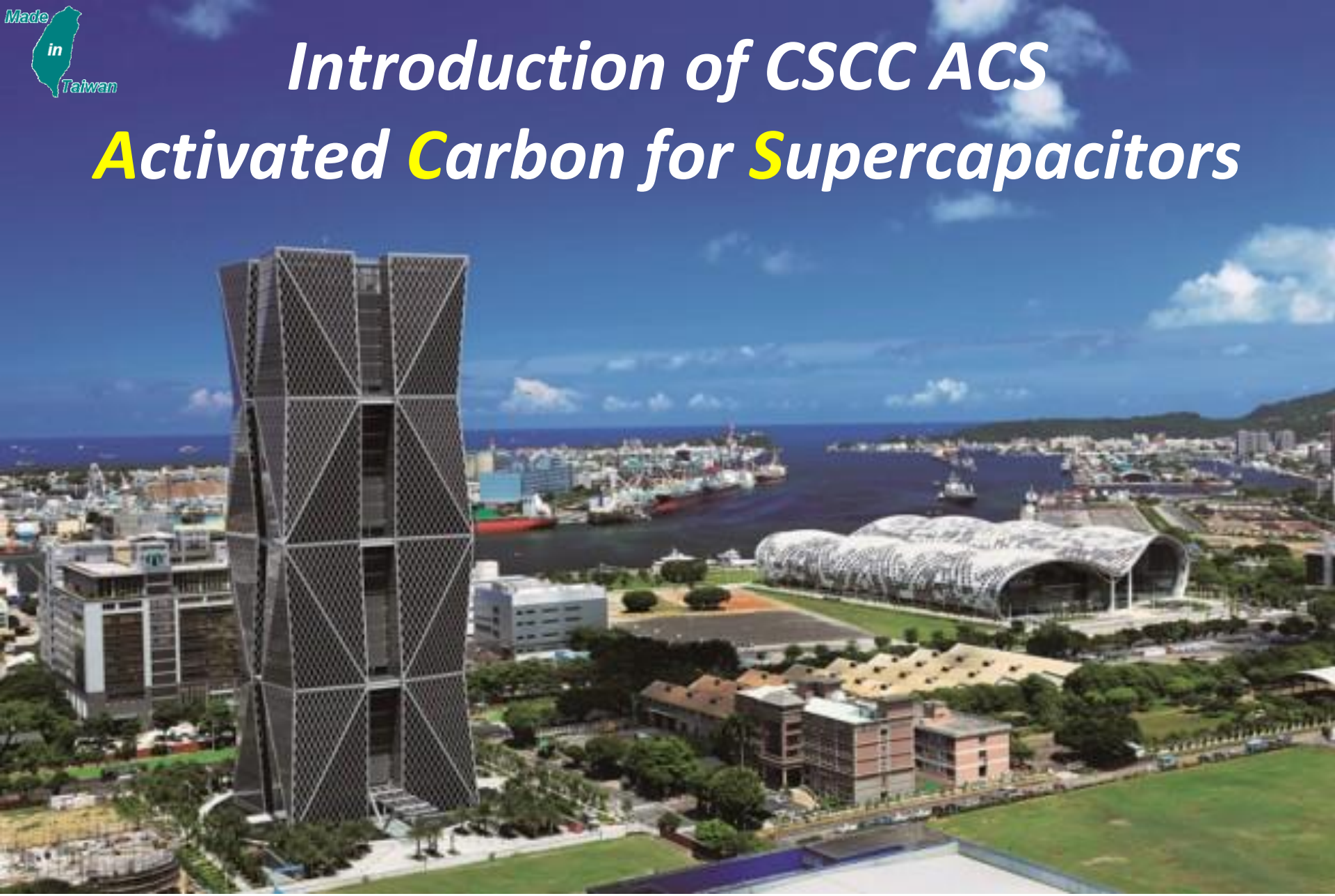
Introduction of CSCC ACS
Activated Carbon for Supercapacitors



China Steel Chemical Corporation

Outline

- ***Company profiles***
- ***Carbon Precursor and Fabrication Process for HQ/ACS***
- ***Material Characterization of HQ/ACS Products and its Capacitor Test***
- ***Technical Facilities***
- ***Summary***

Company Profiles

China Steel Chemical Corporation:

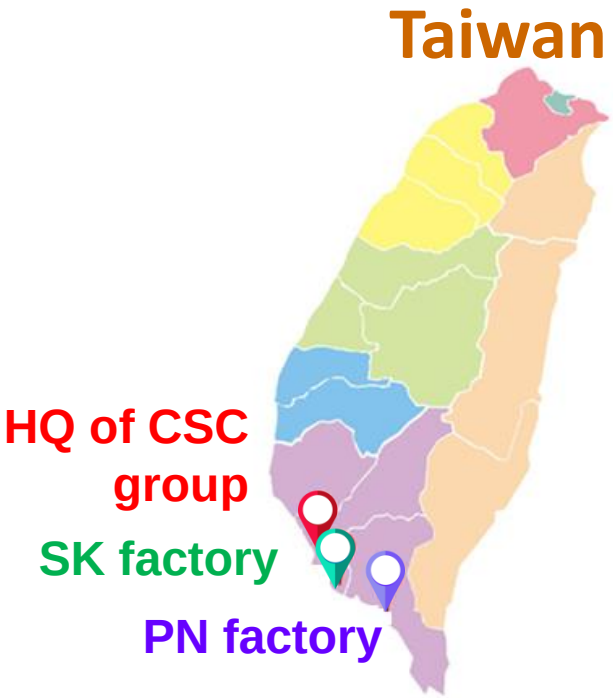
- **Total capital 80M USD**
- **1989** Established
- Around 300 employees, **R&D~30**
- **1997** ISO 14000 certified
- **2002 MCMB Anode Mass Production**
- **2002** ISO 9001:2000 & OHSAS 18001 certified
- **2013** ISO/TS 16949 certified
- **2014** Branch established in Chang Zhou
- **2014 ACS Mass Production**
- **2018 Carbon Material Manufactory established in Ping Nan**

Parent Company

China Steel Corporation:

- **Total capital 5B USD**
- **No. 1 steel supplier in Taiwan**
- Around 9000 employees, R&D >300
- High quality steels for vehicles
- Supply to famous automotive companies

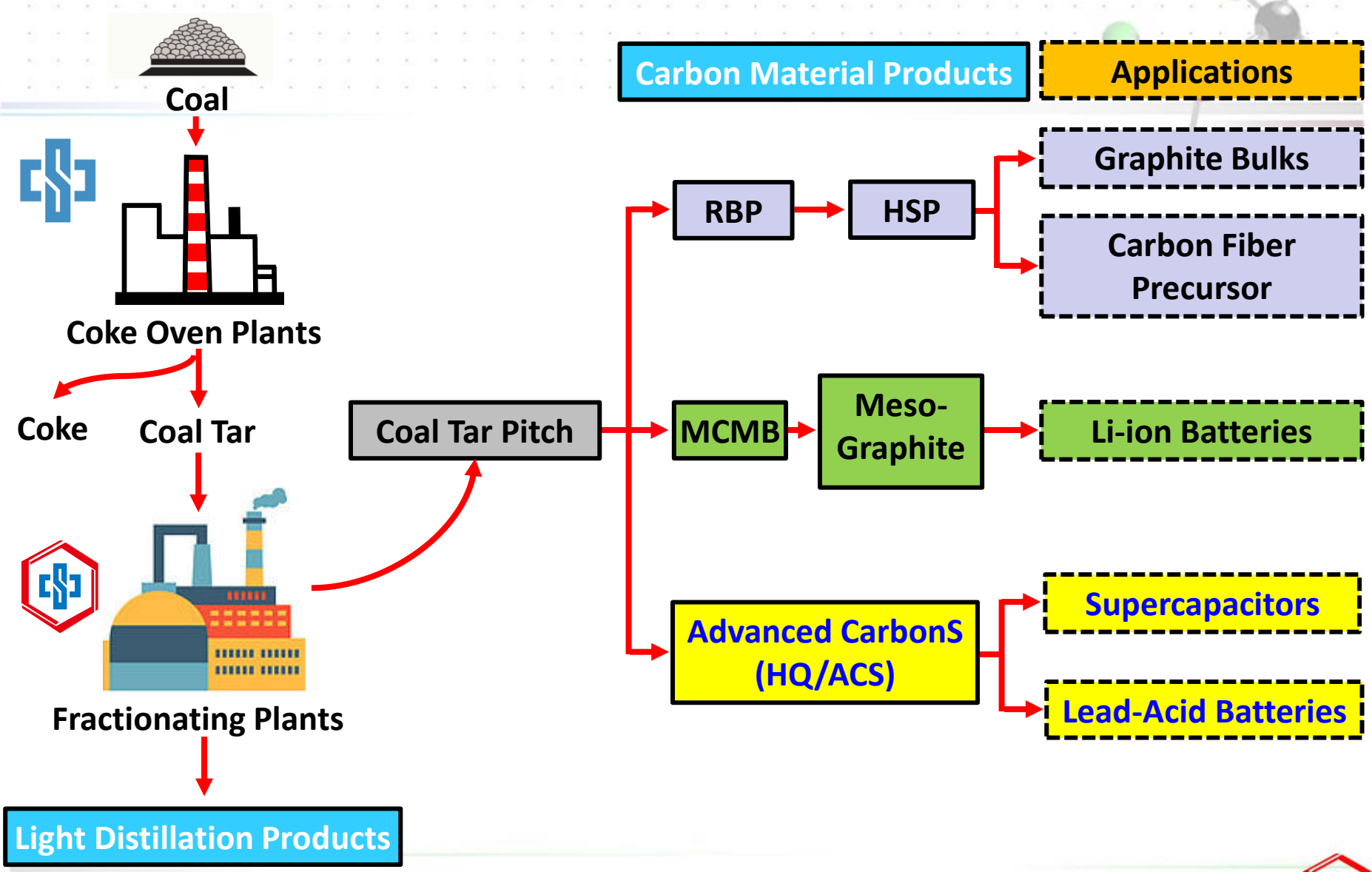
CSCC Graphitization Factory in Southern Taiwan (Ping Nan Factory)



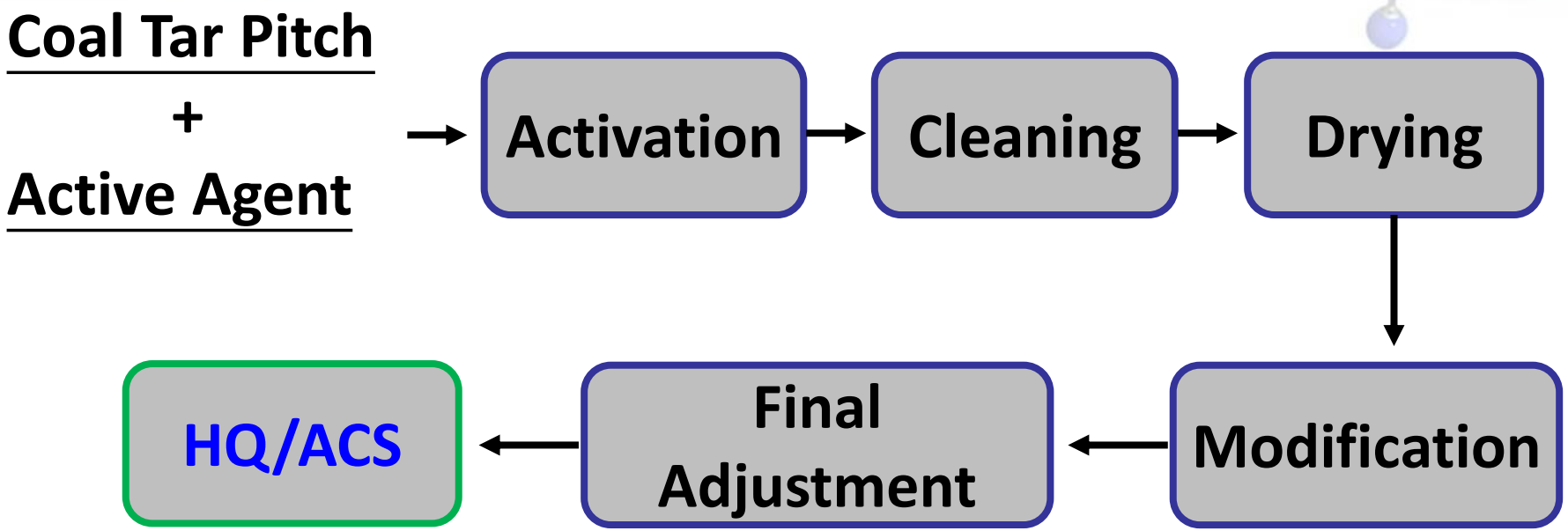
- The land area is ~13 hectares and the first developed area is ~4 hectares.

CSCC Branch in China
(For customer services)

CSCC Product Flow Chart



Fabrication Process of HQ/ACS



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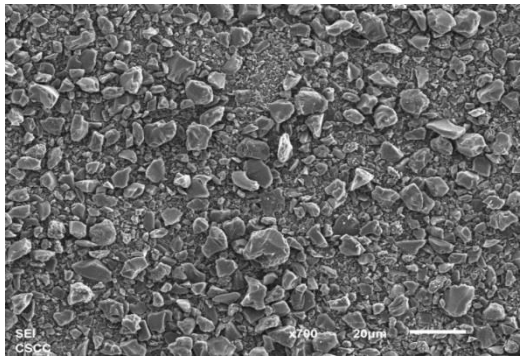
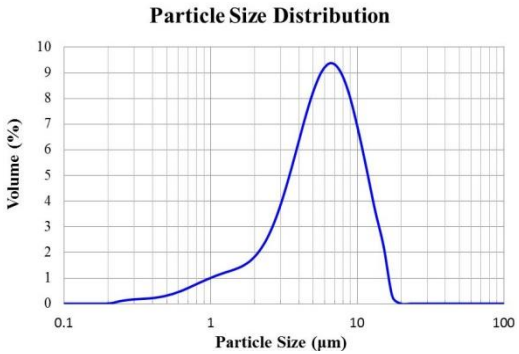
Material Characterization of HQ/ACS

ITEM	UNIT	ACS15	HQ11	ACS20	HQ21	ACS20F
BET	m^2/g	1500	1500	2000	2000	1800
D_{50}	µm	6.5	6.5	6.5	6.5	6.5
H_20	%	< 3.0	<3.0	<3.0	<3.0	< 3.0
Ash	%	< 1.0	<0.3	<1.0	<0.3	< 0.3
Fe	ppm	<60	<40	<60	<40	<40
Cu	ppm	<20	<20	<20	<20	<20
Functionality	Level	Moderate	Moderate	Moderate	Moderate	Low
Gravimetric Cap.	F/g	>110	>110	>130	>130	>120

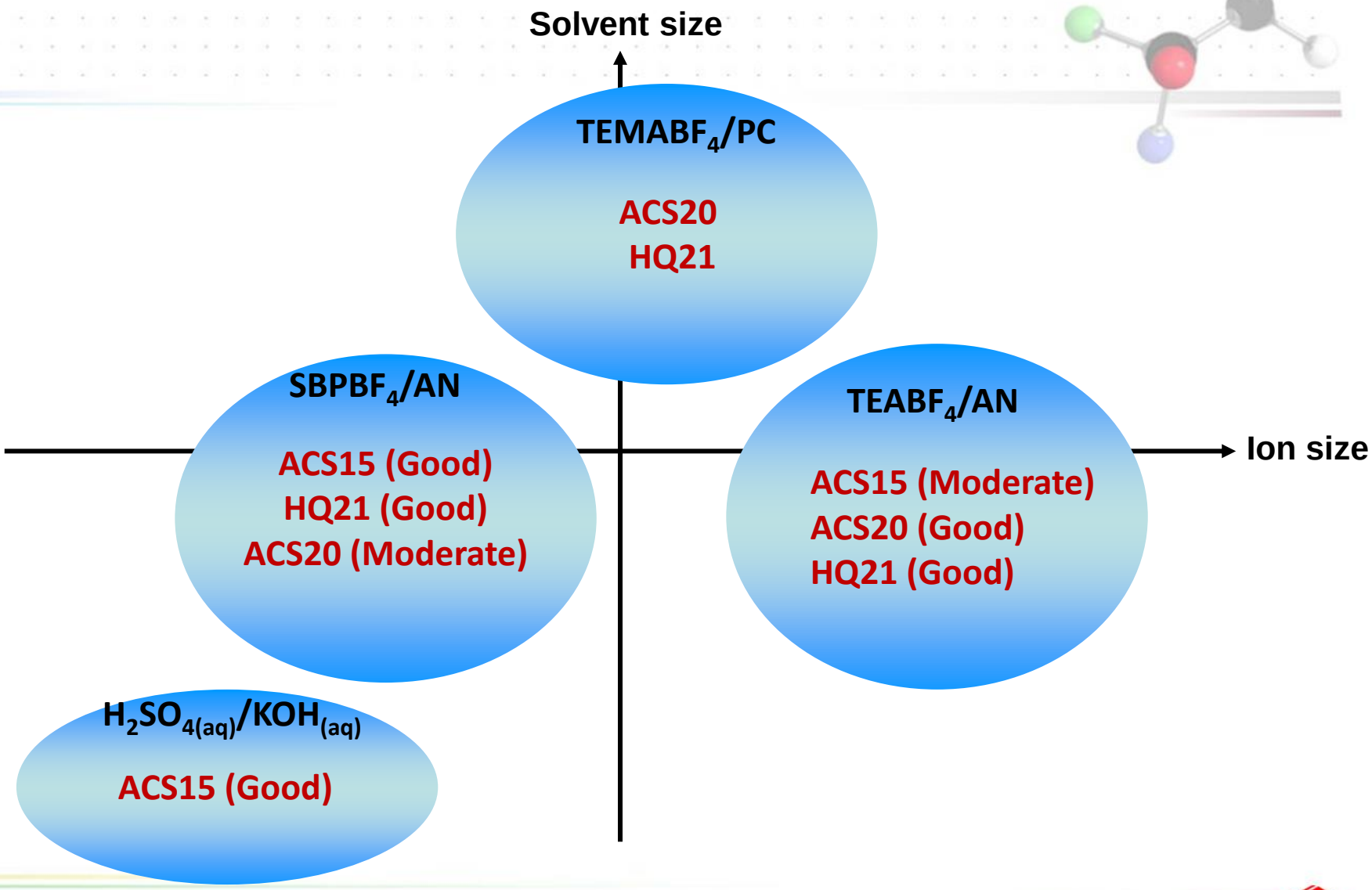




The Features of HQ/ACS

- High Surface Area
- Low Ash
- High Quality
- Better Capacitance

Compatibility of ACS series with electrolytes



ACS Series vs. Competitors

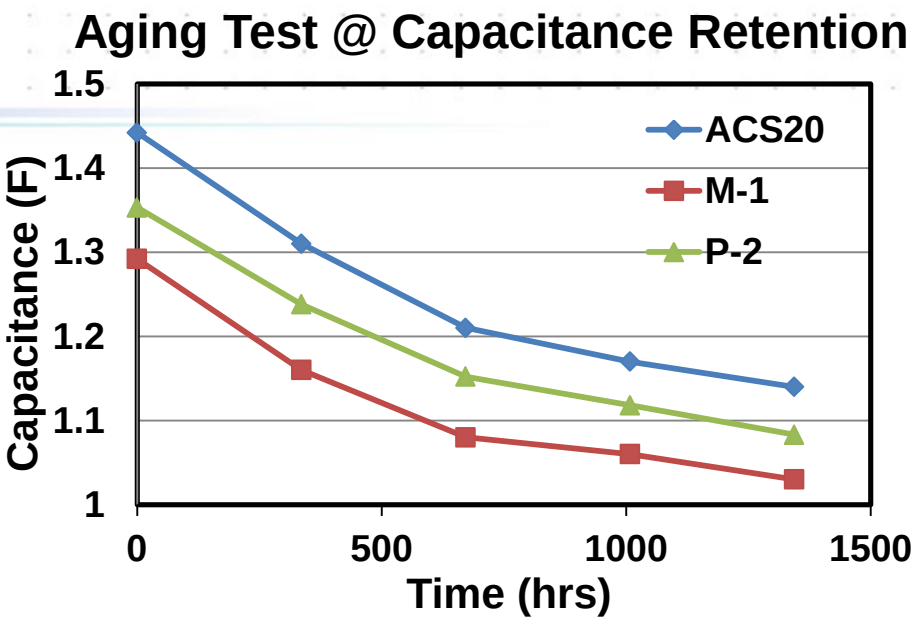
Sample	Particle Size (um)			BET SSA (m^2/g)		Capacitance (F)
	D10 µm	D50 µm	D90 µm	BET m^2/g	DFT m^2/g	
ACS15	2.0	5.6	10.4	1427	1422	**1.44**
Y-1	1.7	5.2	10.7	1578	1586	1.17
ACS20	2.0	5.9	11.7	1978	1749	**1.44**
P-2	2.5	6.0	12.6	1969	1865	1.35
M-1	3.1	5.2	15.4	2156	2013	1.29

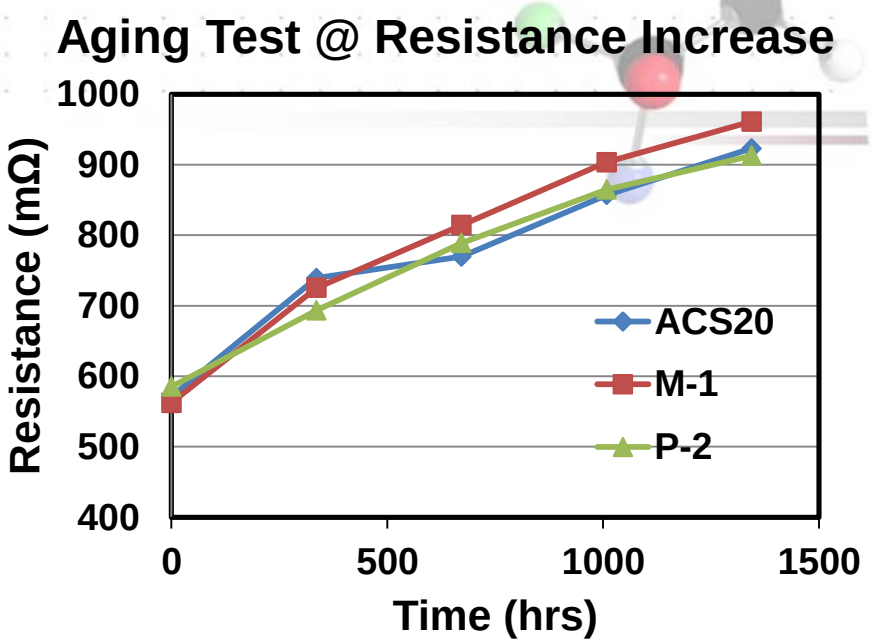
➢ **ACS series show higher initial capacitance.**

***Note:**

1. **1F supercapacitor at 65 °C**
2. AC/**CB**/SBR/CMC=90/**5**/3/2
3. **Electrolyte: 1M $TEABF_4$/AN**

Aging Test @*1F Supercap (65 °C for AN)*



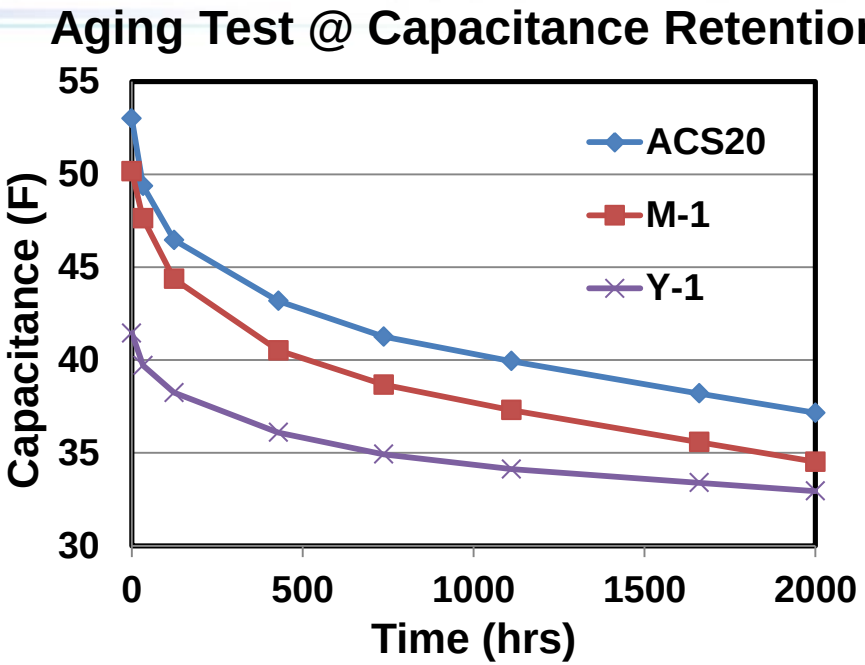


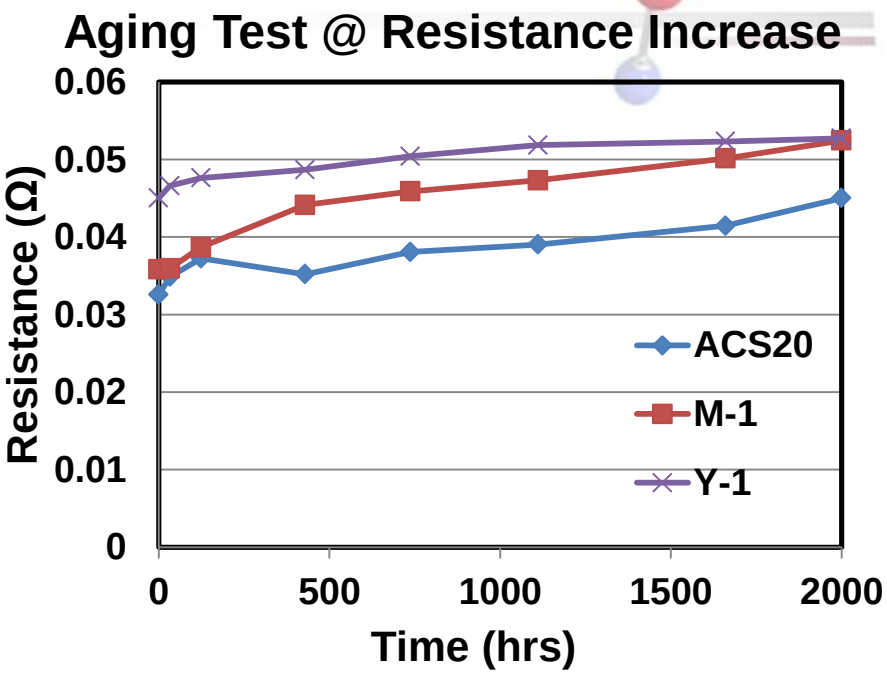
➢**ACS20 shows good retention in capacitance and resistance comparable to M-1 & P-2.**

- AC/**CB**/SBR/CMC=90/**5**/3/2

Outsourcing Research of JME Lab

50F Supercapacitor, Aging Test (65 °C for AN)





➢ **ACS20 shows better capacitance in the whole aging process.**

Customer Feedback @ SBP Electrolyte

50F Supercapacitor, Aging Test (70 °C for AN)

Sample name	Cap (F)	ESR (mΩ)	Cap (F)	ESR (mΩ)	△C/C0	△ESR
	Initial		2000hr aging		%	
ACS15	141%	7.6	111%	12.0	21.6	1.6
Y-1	100%	7.0	84%	10.4	16.3	1.5

- **Electrolyte: $SBPBF_4$/AN**
- **The capacitance of ACS15 is 42% higher than Y-1.**
- **ACS15 pass the 2000hr aging test.**

Electrochemical Characterization of HQ21/ACS

Items	BET (m^2/g)	D50 (μm)	Electrode Density (g/ml)	Gravimetric Cap. (F/g)	Volumetric Cap. (F/ml)
HQ21	2009	6.8	0.54	150 ↑38%	20 ↑33%
ACS15	1476	6.5	0.63	128 ↑17%	20 ↑33%
ACS20	2066	6.6	0.52	147 ↑35%	19 ↑27%
Y-1	1578	5.3	0.56	109	15

*0.4F coin cell (CR2032) Test

**Capacitance test in $TEABF_4$ / AN

HQ21/ACS *vs.* Competitor Y-1

- ☐ Higher Surface Area
- ☐ Better Capacitance
- ☐ HQ21 shows best performance

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Lab Instruments

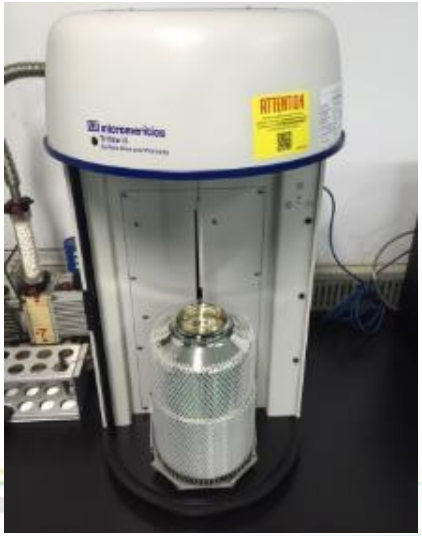
SEM

FIB

ICP-OES

XRD

Specific Surface Area Analyzer (BET)



Specific Surface Area Analyzer (QSDFT)

Particle Size Analyzer

Pilot Line for Electrode Fabrication

Coating Machine (Thank Metal, Japan)

Roll Press & Slitter (BENS, Japan)

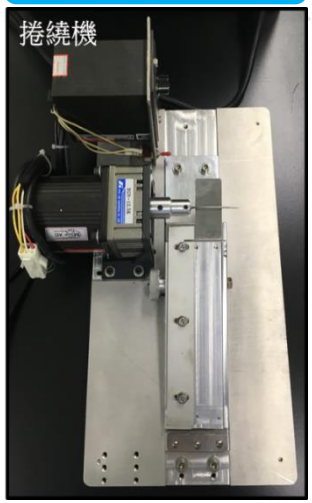
- **Make rolling Single or Double layers electrodes by the pilot line.**

Pilot Line for 10F Cylindrical Supercap.

Scraping

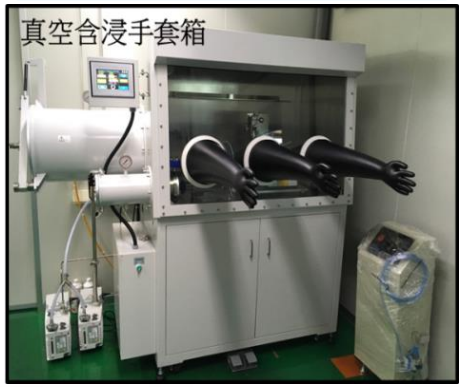
Stitching

Winding

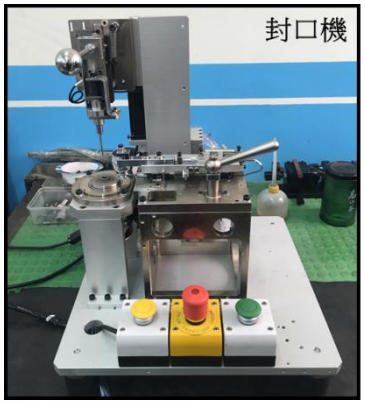


Drying

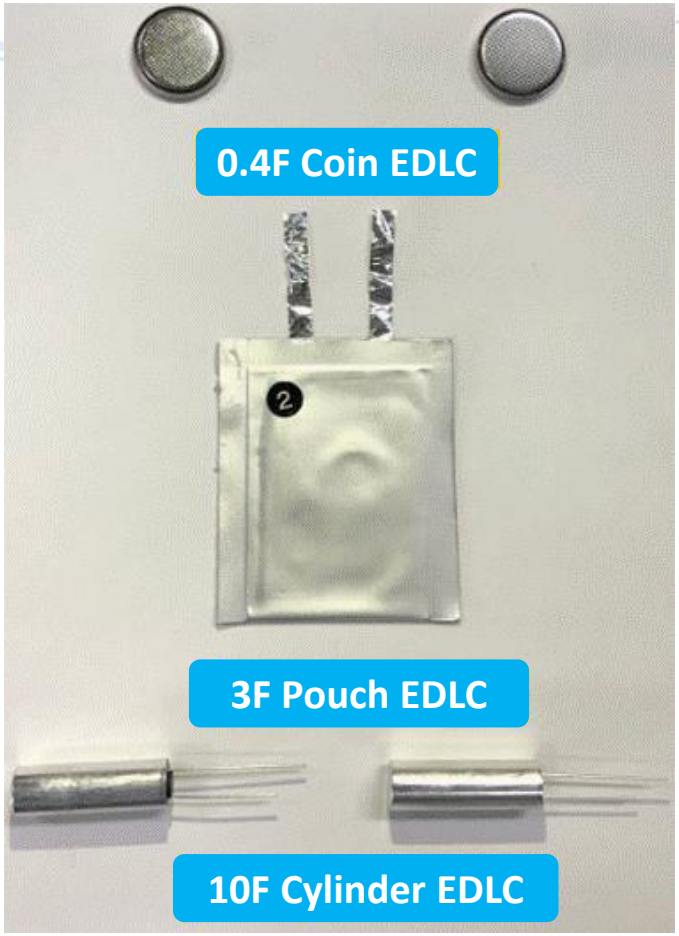
Glove box



Sealing



Instruments for Cell Test



5A & 20A Chargers (MACCOR, USA)

Temperature & humidity chamber -40°C~ 100°C

Summary

1. CSCC can offer high quality of activated carbon products.

2. CSCC can provide customized HQ/ACS products to satisfy customers' demands.

3. ACS series possess higher capacitance and better performance in aging test in comparison with competitors .

Thank You for Your Kind Attention!