

KOREA-EUROPE BATTERY DAY

- MATERIALS
- EQUIPMENT
- BATTERY PRODUCTION PARTS
- EV CHARGER
- RECYCLING
- REPRESENTED BY SAMSUNG

MATERIALS

# KOTRA | KOREA-EUROPE BATTERY DAY

## Dae Joo Electronic Materials

Company has developed their knowledge and technology on vapor phase synthesis & nano-oxide particles since their foundation. From 2011 Dae Joo Corp. started to manufacture silicon-based composite oxide material and commercialized it for the first time in the world.

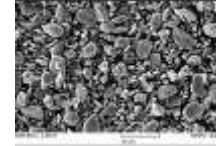


### COMPANY HIGHLIGHTS

<b>Name:</b>	Dae Joo Electronic Materials
<b>Business areas:</b>	Conductive paste, Li-battery anode materials, polymer materials, metal powder, etc.
<b>Headquarter:</b>	Siheung, Gyeonggi, South Korea
<b>Employees:</b>	239 (2020)
<b>Revenue:</b>	€6.65 mil. (2020)
<b>Website:</b>	<a href="http://www.daejoo.co.kr/main.asp">http://www.daejoo.co.kr/main.asp</a>



### PRODUCT PORTFOLIO



#### Anode for Li-Ion Battery

- Silicon-based Li-ion Battery anode materials with capacity up to 4 times higher than that of graphite



#### Polymer Materials

- Insulation materials (molding epoxy resin applicable for electronic parts), materials for LED (epoxy resin showing excellent tensile strength, plasticity and adhesion)



#### Metal Powder

- Silver powder of diverse appearance, size, and specific surfaces in compliance with customers' requirements.

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

<b>Main Customers:</b>	Samsung Electronics, Samsung SDI, LG Electronics, LG Innotek, LG Chem, Partron
<b>Business Relationships:</b>	LG Chem/Partnership/Supply silicon oxide for anode material from 2021, SK Innovation/Partnership/Supply silicon oxide for anode material from 2023

### TECHNOLOGY HIGHLIGHTS

- Silicon based anode materials from Daejoo are those, mixed with existing graphite. With 10% of silicon, materials show 30% higher efficiency than 100% of graphite materials
- Company invests over 10% of its revenue in the R&D activities.
- Dae Joo's productivity of silicon oxide for anode is showing continuous growth. 2019: 20 ton/month, 2020: 100 ton/month, 2023: 700 ton/month (planned)

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## Ecopro BM

Korean-based Li-ion battery cathode material manufacturer, retaining a whole process synthesis technology from precursors to cathode materials and focusing on the development of technology for high-nickel high-volume cathode materials.

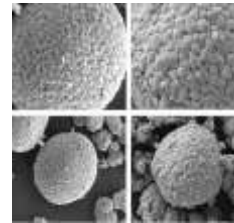


### COMPANY HIGHLIGHTS

**Name:** Ecopro BM  
**Business areas:** Cathode materials for Li-ion battery  
**Headquarter:** Cheongju, Chungcheong, South Korea  
**Employees:** 867 (2020)  
**Revenue:** €260 mil. (2019)  
**Website:** <http://www.ecoprobm.co.kr/eng>

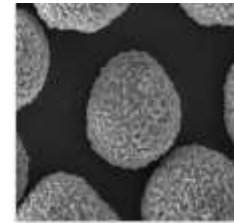


### PRODUCT PORTFOLIO



#### NCA material

- 80% Ni, high-end material with high energy density and optimized costs.
- Customized NCA modeling according to customers' demands.



#### Core Shell Gradient (CSG) NMC material

- Advanced material, allowing realization of high volume and safety with concentration gradient technology
- Evaluation is underway on application to EV as a next-generation material

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

**Main Customers:** Samsung SDI, SK Innovation, LG Chem  
**Business Relationships:** Samsung SDI/Joint Venture/EcoPro EM (2020), total investment \$ 96.9 mil., 60% Ecopro BM & 40% Samsung SDI

### TECHNOLOGY HIGHLIGHTS

- World 2<sup>nd</sup> market share in the field of NCA cathode materials.
- R&D investment in 2019 comprised €4.34 mil. – 2% of the revenue.
- The company is developing various precursor synthesis technologies to manufacture high-density precursors.
- EcoPro BM intends to increase its production capacity for cathode materials, including the joint venture with Samsung SDI, by 150,000 tonnes to 180,000 tonnes by 2023.

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## ENCHEM

Leading Korean manufacturer of additives and electrolytes, used in EV, ESS, etc. Enchem has been ranked 1<sup>st</sup> growth in the electrolyte industry (CAGR 75%, Average Marketing 25%) and Enchem is main supplier of LG Chem, who has 12% supply rate.



### COMPANY HIGHLIGHTS

**Name:** Enchem Ltd  
**Business areas:** Electrolytes (for EV, ESS, IT equipment), electrolyte additive  
**Headquarter:** Jaecheon, Chungcheong, South Korea  
**Employees:** 106 (2018)  
**Revenue:** €101 mil. (2019)  
**Website:** <http://www.enchem.net/eng/main.php>



### PRODUCT PORTFOLIO



#### Electrolytes for li-ion batteries and EDLCs

- In-house electrolyte development, including use of binary-salt electrolytes (with LiFSI, LiPO<sub>2</sub>F<sub>2</sub>, LiDODFP and LiODFB)
- Compliance with European regulations of environmental protection
- In-house production of high-performance additives to reduce the resulting production costs
- Synthesis of novel electrolyte additives and production ramp-up
- In-house testing facility for electrochemical validation

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

**Main Customers:** LG Chem, SK Innovation, LISHEN, ATL  
**Business Relationships:** Kunlun Engineering/Joint Venture & Co-Development /Largest electrolyte production amount in China with capacity of Enchem (25,000 ton/year) and Kunlun (60,000 ton/year)

### TECHNOLOGY HIGHLIGHTS

- Enchem has built a factory in Wroclaw, Poland to supply electrolyte to LG Chem with planned production capacity of 40,000ton/year by 2022. Raw materials (i.e., salt, solvent, additives) will be supplied by European manufacturers. With this company is aiming to minimize the transportation costs and related risks.
- Enchem has a global footprint with production sites in 3 continents and total production capacity of 105,000 ton/year.

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Hansol chemical

Hansol chemical has started its business manufacturing hydrogen peroxide used in semiconductor and electronic materials since 1980. In 2018 Hansol expanded its business area to materials for secondary battery. In 2020 Hansol chemical and Samsung SDI built a business partnership to co-develop next generation silicon anode materials.



## COMPANY HIGHLIGHTS

<b>Name:</b>	Hansol chemical
<b>Establishment:</b>	1980
<b>Business areas:</b>	Anode materials (Si-Anode), Chemical & electronic materials
<b>Headquarter:</b>	Seoul, South Korea
<b>Employees:</b>	500 (2019)
<b>Revenue:</b>	€440 mil. (2019)
<b>Website:</b>	<a href="https://www.hansolchemical.com/en/main.do">https://www.hansolchemical.com/en/main.do</a>



## PRODUCT PORTFOLIO

Products



### Silicon anode material

- Compared to conventional graphite anode material, silicon anode of Hansol chemical has appx. x10 higher energy capacity.
- Samsung Advanced Institute of Technology (SAIT) has supported Hansol chemical to develop silicon anode material.
- Starting mass production of silicon anode material (planned in 2021), it is expected for Hansol to show revenue increasing ratio about 15%.



### Anode binder

- Hansol had achieved a patent related to anode binder in 2016 and released the binder in 2019. Hansol chemical is the only company in Korea, who produces anode binder.

## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

<b>Business Relationships:</b>	Samsung SDI / Business and R&D partner / co-developing silicon anode materials
<b>Main Customers:</b>	Samsung SDI (Silicon anode material) / 2019~ SK Innovation & Samsung SDI (Anode binder) / 2019~

## TECHNOLOGY HIGHLIGHTS

- Hansol chemical has constructed a pilot production line in its manufacturing facility in Jeonju, a city in south-west area of South Korea. After the line is certified, Hansol would initiate mass production instantly. Hansol would invest about 102.7 millions of Euro til 2023.
- Hansol electronic material in Xian, China, supports oversea sales of hydrogen peroxide from 2012.

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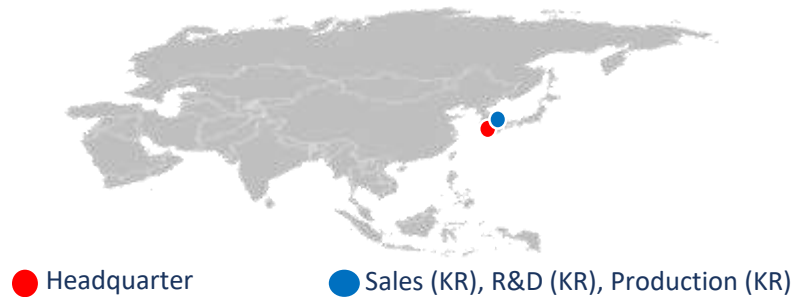
L&F

Cathode material manufacturer for Li-ion batteries, who supplies its products to Korean leading battery manufacturers: LG Chem, Samsung SDI and SK Innovation.



## COMPANY HIGHLIGHTS

**Name:** L&F  
**Business areas:** Cathode materials (for EV, E-Bike, ESS, etc.)  
**Headquarter:** Daegu, Gyeongsang, South Korea  
**Employees:** 481 (2020)  
**Revenue:** €238 mil. (2020)  
**Website:** <http://eu.landf.co.kr/>



## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

**Main Customers:** LG Chem, Samsung SDI, SK Innovation EMT  
**Business Relationships:** LG Chem/Supply chain/Cathode materials

## PRODUCT PORTFOLIO



- Layered structure, applied in power tools, EV, ESS. Price-efficient compared to  $\text{LiCoO}_2$ , high storage capacity.



- Layered structure, still widely applied in small IT equipment, such as smart phones.



- Spinel structure, applied in power tools and ESS. Lower cost but also lower energy density compared to NMC

## TECHNOLOGY HIGHLIGHTS

- Korean-only manufacturer who mass-produces next generation cathode material – NCMA and supplies it to LG Chem since June 2020. The company aimed to increase the annual production amount from 30,000 tons to 40,000 tons by the end of 2020 to cover the growing demand.
- L&F is planning to increase the current annual production amount of NCMA to 70,000 tons by 2023.



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## NEBA Corporation

Leading Korean manufacturer of lithium metal and lithium metal foil, used in Lithium primary and secondary batteries as an anode material, NEBA corporation has been ranked 1st growth in the lithium metal industry in Korea.

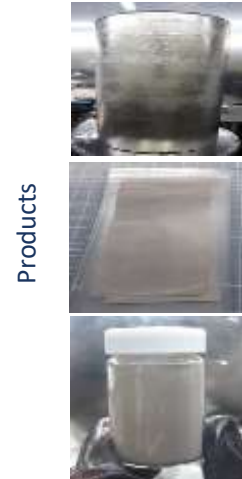


### COMPANY HIGHLIGHTS

Name:	NEBA Corporation
Business areas:	Lithium metal ingot, foil, powder, lithium metal alloy
Headquarter:	Daejeon, South Korea
Employees:	10 (2020)
Revenue:	€1 mil. (2020)
Website:	<a href="http://www.neba.co.kr">http://www.neba.co.kr</a>



### PRODUCT PORTFOLIO



### Lithium metal for Li primary and secondary batteries

- In-house lithium metal ingot, foil, powder development
- Compliance with European regulations of environmental protection
- In-house production of high-performance lithium metal foil with the coating to enhance safety
- In-house testing facility for electrochemical validation

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers :	LG Chem., SK Innovation
Business Relationships :	Co-development with LG Chem. / business partnership with Chori Korea, a subsidiary of Chori company in Japan

### TECHNOLOGY HIGHLIGHTS

- NEBA corporation is a technology leading company newly founded in 2017 and has focused on the production of lithium metal related products, such as high pure lithium metal ingot, foil, alloy foil, and powder, which are mainly aimed for the application to lithium batteries.
- NEBA corporation has built a factory in Daejeon to supply lithium metal products to customer Vitzrocell, LG chem., and under way of continual expansion of production capacity to several hundred tons of lithium metal products.

## Solus Advanced Materials

Battery copper foil is a core material of the electric car battery. Solus Advanced Materials has completed its development of high-end, compact, high-efficiency battery copper foil that can help increase the mileage of electric cars. The battery copper foil plant that was constructed in Hungary in early 2020 is the only battery copper foil production base in Europe. Hungary plant already started mass production in 2020 for global top battery makers. Solus Advanced Materials will enhance its competitiveness steadily through the stable production of high-quality battery copper foil.

### COMPANY HIGHLIGHTS

Name:	Solus Advanced Materials
Business areas:	Battery Copper Foil
Headquarter:	Seoul, South Korea
Employees:	820 (2020)
Revenue:	\$223 mil. (2020)
Website:	<a href="https://www.solusadvancedmaterials.com/en">https://www.solusadvancedmaterials.com/en</a>



### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers :	Global top tier battery makers
Business Relationships :	(1) Started mass production and delivery for customers in 2020. (2) Discussing the next long term delivery agreements with the customers.

### PRODUCT PORTFOLIO



#### Copper Foil for Lithium Ion Batteries(LIB) in Electric Vehicles(EVs)

- **BF-plainstainproof** (Cylindrical/Prismatic/Pouch type)  
: Standard battery copper foil for electric vehicle batteries
- **SR-plainstainproof** (Cylindrical/Prismatic/Pouch type)  
: Contributing to yield improvement by upgrading processability within the battery production process with high strength properties before heat treatment and increasing the life and stability of cylindrical and square batteries with high elongation properties after heat treatment.
- **HTS-plainstainproof** (Pouch/ Prismatic type)  
: Possible to load much more active materials with high strength properties, contributing to the minimization of deformation at the time of battery charge and discharge by maintaining strength after heat treatment.

### TECHNOLOGY HIGHLIGHTS

- Solus Advanced Materials has built a factory in Hungary, which is the only battery copper foil manufacturer in Europe, to supply copper foil to customers in Europe.
- Hungary Plant (Volta Energy Solutions) continuously implement ground technologies and manufacturing know-how from the mother company of copper foil - the 'Circuit Foil Luxembourg'- which is the world's 1<sup>st</sup> inventor of a battery foil and is an affiliate of Solus Advanced Materials. As the only local battery copper foil manufacturer in Europe, it minimizes the transportation costs, time and related risks to customers in Europe.
- Hungary production capacity expansion is planned to meet the battery customers' demand of 75,000 tons by 2025.

# KOTRA | KOREA-GERMANY E-MOBILITY PARTNERING

## Soulbrain

Chemical material manufacturer, who produces qualified materials for semiconductor, display and electronics. Soulbrain has localized manufacturing of hydrogen fluoride (HF) in Korea, making it independent of China. With this accomplishment Soulbrain reached highest revenue in 2019 (€1 mrd.) which is about 6.88% higher.



### COMPANY HIGHLIGHTS

<b>Name:</b>	Soulbrain
<b>Business areas:</b>	Secondary Battery Materials (Electrolyte, Lead Tab), Semiconductor Materials (Etchant, CMP Slurry, Precursor), Electronic Materials for EV
<b>Headquarter:</b>	Pangyo, Gyeonggi, South Korea
<b>Employees:</b>	1,214 (2020)
<b>Revenue:</b>	€1 bn. (2020)
<b>Website:</b>	<a href="http://www.soulbrain.co.kr/en/">http://www.soulbrain.co.kr/en/</a>



### PRODUCT PORTFOLIO



#### Electrolytes

- Special manufacturing process maintaining low moisture and HF content;
- Development and supply of a variety of functional electrolytes to improve the lifetime and performance of Li-ion batteries (i.e., electrolytes with gas generation controlling and overcharge prevention capabilities)



#### Lead Tab

- Manufacturing of high-quality lead tab products, which can perfectly block the leakage of electrolyte through differentiated electroplating technology and surface coating technology.

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

<b>Main Customers:</b>	Samsung SDI, SK Innovation, A123, Johnson Controls, Samsung Electronics, SK Hynix, LG Display,
<b>Business Relationships:</b>	Multiple joint ventures with Japanese chemical companies. (Fect Co./with Stella Chemifa/1994, MC Solution/with Mitsubishi Chem/2007, Soulbrain-Rasa/with Rasa, 2016)

### TECHNOLOGY HIGHLIGHTS

- Soulbrain's electrolyte is applicable in IT, xEV and ESS. Especially it shows HP(High Purity) Grade Solvents: 99.9% and HP Grade Additives: 99.9%. Cylinder type: 1L bottle, 18L/200L Cylinder
- Constructed production facility in Hungary in 2020 with €2,150 mil. invested and total square of 4,630m<sup>2</sup>.

EQUIPMENT

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## CONTROLWORKS



Controlworks provide Rapid-prototype controller, engine and sensor, which are sensitive and fast in control logic realization and Virtual battery cell for developing BMS SW and HW.

### COMPANY HIGHLIGHTS

Name: CONTROLWORKS

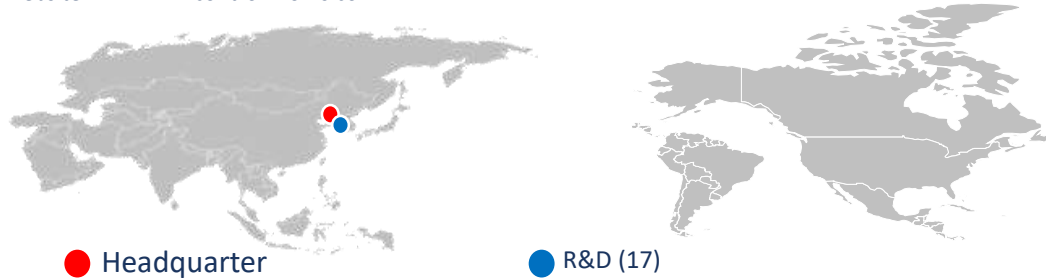
Business areas: xEV control unit validation, Autonomous Driving

Headquarter: Seoul, Korea

Employees: 41

Revenue: 6M USD

Website: [www.control-works.co.kr](http://www.control-works.co.kr)



### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : HYUNDAI MOTOR GROUP, LG, SK, SAMSUNG

Business Relationships : Battery Cell Simulator & HIL(HW in the Loop) for xEV control units  
(e.g. Battery Management System)

### PRODUCT PORTFOLIO

#### BCS-L5

##### Entry Model

- Update rate 2Hz
- 128cell stack (max.550V)
- Fault insertion not included
- Current and voltage measurement (opt.)



BCS-L5

#### BCS-P5

##### Standard Model

- Update rate 20Hz
- 256cell stack (max.1000V)
- Fault insertion (opt.)
- Current and voltage measurement (opt.)



BCS-P5

#### BCS-XP5

##### Performance Model

- Update rate 100Hz
- 256cell stack (max.1000V)
- Fault insertion
- Current and voltage measurement (incl.)



BCS-XP5

### TECHNOLOGY HIGHLIGHTS

- Mostly used Battery Cell Simulator by one of Major Korean OEMs
  - customizable with request
  - CE certified

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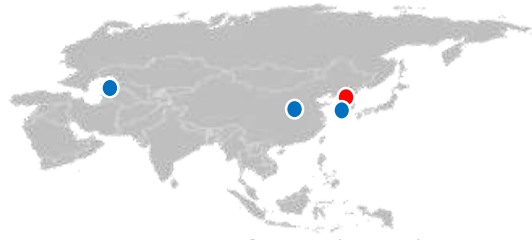
## Daebo Magnetic Co.,Ltd

Daebo Magnetic is Korea-based Electro Magnetic Filter manufacturer, which is used to remove iron components from powder and liquid form with equipment.



### COMPANY HIGHLIGHTS

Name: DAEBO MAGNETIC CO.,LTD.  
Business areas: MAGNETIC RELATED EQUIPMENT /  
Headquarter: Gyeonggi-do, South Korea  
Employees: 60 (2020)  
Revenue: €13 mil. (2020)  
Website: www.daebo.com



● Headquarter

● Sales (CN, US) , , Production (KR)

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : SAMSUNG SDI, LG CHEM, CATL, UMICORE, BYD, SHANSHAN, GRM, CXCT, BTR, GEM, JI CHEN, LIBAO, ALBEMARLE, ....

Business Relationships : Joint Venture & Co-Development / Lithium secondary battery material and cell manufacturer

### PRODUCT PORTFOLIO



Products



- Manage and discharge foreign substances (iron components) inside the battery
- Remove iron components from powder and liquid form with equipment
- Manufacturing of Lithium Deferrous Equipment for High Purity Lithium Production
- Equipment that manages iron components in ppb units and can de-steel fine powder

### TECHNOLOGY HIGHLIGHTS

- Powder or gel, and Colloid are passed within a strong magnetic field. Remove the magnetic substance by filtering it with a ferromagnetic substance filter.
- Lithium Battery Industry Ceramic Industry, Advanced Material, Chemistry, Mining Industry, Powder Food Industry
- It is used to completely remove trace amounts of medicine and ferromagnetic material (iron, STS430) from the raw material as a principle to maximize magnetic force by concentrating magnetic force.

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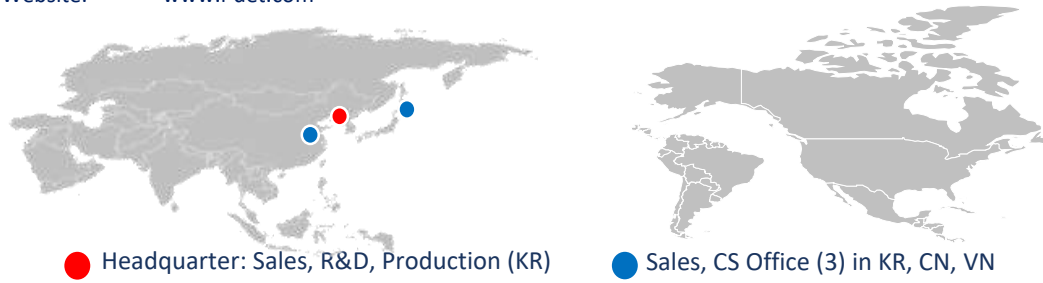
## DE&T Co.,Ltd

We, DE&T, is a manufacturer specialized in laser notching machine. Using laser can improve production capability more than CNC tool cutting method. Our customer are already widely spread in Asia, China/Taiwan/Korea/Japan/Vietnam, include SAMSUNG, LG, especially LGC is our main customer in battery filed. Now we would like to recommend our machine with mature technic and experience gotten actual field to European customers. I believe our machine will help and improve Europe battery electrode/assembly process quality.



### COMPANY HIGHLIGHTS

Name: DE&T Co.,Ltd.  
Business areas: Secondary Battery Electrode process machine  
Headquarter: Osan City, Korea  
Employees: 150 (2021)  
Revenue: US\$ 162M  
Website: www.i-det.com



### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

- Main Customers : LG Chem (LGES), SDC, LGD, BOE, TIANMA, VISIONOX, AUO etc.
- Business Relationships : 1<sup>st</sup> Vendor in Cathode/Anode electrode process, assembly process in Domestic & overseas site of LG Chem.

### PRODUCT PORTFOLIO



- Laser Half Slitter, Laser Slitter (for electrode process)
- Laser Notching Equipment (for assembly process)  
: it consists of Rewinder+Notching+Dry+Unwinder units.

### TECHNOLOGY HIGHLIGHTS

- 1) DE&T Laser Notching machine is capable of both areas (regardless of coating area and non-coating area)**  
Non-coating area can be applied to both notching methods (laser & press), but the coating area has traditionally been cut with a press method due to problems such as short defects caused by spattering crumbs in the notching area when using laser but DE&T laser notching method is excellent for notching the active part with special laser use and optimization of process conditions.
- 2) Excellent effect on reducing moisture content through driving drying.**  
Batteries are susceptible to moisture, so battery makers are investing heavily in the process to minimize moisture content. Plus, in the recent trend of high nickel application to increase battery capacity, lowering the level content in high-absorbability Nickel is considered as a critical process.  
The DE&T laser notching machine consists of **Rewinder+Notching+Dry+Unwinder** Unit, which is excellent for reducing moisture content by driving on the Notching Line and drying immediately.
- 3) Increase production efficiency and reduce running cost.**  
Comparing to the traditional press method, DE&T laser notching machine has the following advantages
  - No extra molds or jigs required, as only laser parameters need to be adjusted– Low Running cost
  - Less breaking rate at 1/6 tension compared to the press (increase yield by 10%-15% compared to the press)

# KOTRA | KOREA-Europe Battery Day

## Jeil Maschine Co.,LTD

Jeil Machine Co., Ltd.'s medium and large-sized Planetary Disperser Mixer has the largest production/delivery performance in Korea, and its excellence has been recognized by customers. Based on this, we have the ability to manufacture and propose systems that actively respond to various and detailed customer specifications.



### COMPANY HIGHLIGHTS

Name:	JEIL MACHINE CO., LTD.
Business areas:	Process Equipment for Secondary Battery, Food & Pharmaceutical, Chemical & Defense
Headquarter:	Icheon, Gyeonggi-Do, Korea
Employees:	102
Revenue:	44 Million USD
Website:	www.jeilm.co.kr



### PRODUCT PORTFOLIO

Products	 <b>Battery Application</b>	<ul style="list-style-type: none"><li>Small Secondary Battery</li><li>Large Capacity Battery</li><li>High Efficiency Battery</li><li>Next Generation Battery</li></ul>
	 <b>Food &amp; Pharmaceutical</b>	<ul style="list-style-type: none"><li>Solid Formulation Line</li><li>Injection Line</li><li>Extraction and Concentration System</li></ul>
	 <b>Defense &amp; Chemical</b>	<ul style="list-style-type: none"><li>Chemical &amp; Industries</li><li>Explosive &amp; Propellant</li><li>Synthetic Plant</li></ul>
	 <b>Powder Handling</b>	<ul style="list-style-type: none"><li>Secondary Battery</li><li>Food &amp; Beverage</li><li>Chemical &amp; Automobile</li></ul>

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers :	Samsung SDI, LG Energy Solution, SK Innovation, Northvolt, Hanhwa, Poongsan and LIG nexone.
Business Relationships :	Supplying turn-key based Battery Slurry Mixing process to major Korean company including its overseas factory. Northvolt project in on going now, and it will be expanded total 8GWh x 5 factory.

### TECHNOLOGY HIGHLIGHTS

- Jeil Machine can manufacture 50 mixing equipment at the same time by securing sufficient working space, and has its own manpower including processing equipment. (Factory site total are : 16,055 m2, 5 factories for machining and assembly)
- Jeil Machine is developing equipment to meet the needs of various customers through its own design, and is realizing customer satisfaction with various patents and advanced technology.



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PNT

Machine manufacturer specialized in roll-to-roll converting and automation machines. Approximately 80% of machines for mass production of cell electrodes used by Korea 3 major battery cell manufacturers are made by PNT. PNT holds Korean No.1 market share (40%) in the field of secondary battery equipment.



## COMPANY HIGHLIGHTS

<b>Name:</b>	PNT
<b>Business areas:</b>	Machinery for mass-production of lithium-ion battery electrodes, separators, copper foil, etc.
<b>Headquarter:</b>	Gumi, Gyeongsang, South Korea
<b>Employees:</b>	599 (2020)
<b>Revenue:</b>	€238.5 mil. (2019)
<b>Website:</b>	<a href="http://epnt.co.kr/?page_id=9478&amp;lang=en">http://epnt.co.kr/?page_id=9478&amp;lang=en</a>



## PRODUCT PORTFOLIO



### Electrodes Coating Machine

- Production speed 100m/min, foil width/thickness max. 1400mm/6 $\mu$ m-30 $\mu$ m, coating process: slot-die, sequential double-sided, double-deck structure, heating source: steam or heat transfer oil



### Calendering Machine

- Production speed 120m/min, line pressure 6.4ton/cm, cathode: hot single rolling, anode: tandem cold rolling; upper roller: fixed, lower roller: moves up and down



### Slitting Machine

- Production speed max. 120m/min, foil width max. 700mm, burr size below 15 $\mu$ m, slitting process: circular slitting knife, WC (tungsten carbide), defect inspection system (vision inspection and labelling system)

## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

<b>Main Customers:</b>	LG Chem, Samsung SDI, SK Innovation, EVE, LG Electronics
<b>Business Relationships:</b>	LG Chem/Cooperation/Production challenge of 6 $\mu$ m-copper foil solved with PNT's equipment (2020)

## TECHNOLOGY HIGHLIGHTS

- Company follows latest technological trends, such as pushing unit on rewinder for logistic automation after slitting process, and accurate detecting with artificial intelligent vision inspection system.
- With growing EV battery market, PNT is planning to construct 4<sup>th</sup> production facility in Gumi, Korea, until 2022 to fulfill growing demand. Currently 80 coaters can be manufactured per annum.
- With PNT's machinery SK Nexilis manufactured world thinnest copper foil (4 $\mu$ m)

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## PNE Solution

Company is developing battery test systems and EV charging systems and infrastructure. With its technology know-how and experience, the company has created both local and global network. PNE Solution is supplying their charging solution to Japan, China, America and Europe.



### COMPANY HIGHLIGHTS

<b>Name:</b>	PNE Solution
<b>Business areas:</b>	Battery formation systems, EDLC aging system, pack tester, ESS, BEV charging Infrastructure
<b>Headquarter:</b>	Suwon, Gyeonggi, South Korea
<b>Employees:</b>	263 (2020)
<b>Revenue:</b>	€112 mil. (2020)
<b>Website:</b>	<a href="http://www.pnesolution.com/eng/main/">http://www.pnesolution.com/eng/main/</a>



### PRODUCT PORTFOLIO



#### Formation Equipment (for Li-ion Battery and EDLC)

- Provide turnkey solution of formation from charge/discharge process to logistics system
- Suitable for all types of batteries (prismatic, cylindrical and pouch)



#### Cycler

- Covers wide range of applications, battery cells, modules, packs (suitable current range according to test components, e.g. max. 1000A for cells)



#### Energy Storage System (ESS)

- PNE's ESS covers variety of applications, from house application to industrial (1kW – 2.5MW), additionally Hybrid and Outdoor ESS also.
- Turnkey solution including Consulting and Suggestions, Design and Construction and Maintenance Service.

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

<b>Main Customers:</b>	SK Innovation, Hanwha, LG Chem, Samsung SDI, ORIX, CRRC, Hyundai-Kia Motor Group, CATL
<b>Business Relationships:</b>	Northvolt/ Supply Chain/ Battery formation and cycler equipment (2020, €1.5 mil.)

### TECHNOLOGY HIGHLIGHTS

- PNE Solution shows remarkable delivery performance all over the world. Total 60GWh (Korea: 23GWh, Europe: 5GWh, China: 28GWh, USA 4GWh)
- PNE Solution also shows great production capacity. Total 40GWh simultaneous production capacity both in China and Korea
- PNE Solution shows growing investment budget in R&D (from \$2.1 mil. in 2016 to \$3.44 mil. in 2018)

# KOTRA | KOREA-Europe Battery Day

## SEC Co., Ltd ( SEC Europe – Nanotech Digital GmbH)

SEC Co.,Ltd has been developing and selling equipment for inspection & analysis machine for over 20 years. Since establishment in 1991, we have been continually developing the highest quality of e-beam inspection equipment in Korea. The first and only X-ray tube development & maker in Korea, 2<sup>nd</sup> in the world and 1<sup>st</sup> in Korea, Tabletop SEM development.



### COMPANY HIGHLIGHTS

Name: SEC Co., Ltd  
Business areas: Industrial X-ray inspection systems, Tabletop SEM, FCB equipment, Linear Accelerator  
Headquarter: Suwon, South Korea  
Employees: 177(2020)  
Revenue: €30 mil. (2020)  
Website: <https://www.seceng.co.kr>



### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : Samsung, LG Chem, LG innotek, Murata

Business Relationships : Battery inspection systems is developed to inspect and analysis for smartphone battery. Based on these defect analysis and inspection data. It is applied in AXI(Automated X-ray Inspection) format to various field such as connectors for vehicles, chips, and batteries for EV.

### PRODUCT PORTFOLIO

- X-ray
- High speed CT inspection images
- Distance between Anode & Cathode can be inspected automatically
- In-line Li battery inspection ( Cylindrical, Prismatic and Pouch)
- In-line EV Pouch battery with 3D CT inspection systems
- Tabletop SEM
- Tabletop SEM is used for analysis of material
- Developed with Minimization of module for normal SEM

### TECHNOLOGY HIGHLIGHTS

- The first & only X-ray tube manufacturer in Korea since 2006 and
- High speed & High quality automatic 3D CT X-ray inspection system
- Image processing filters and automatic inspection algorithms
- Product damage free by pulsed X-ray and filter technique
- Sales records of X-ray systems including AXI(Automated X-ray Inspection) systems for secondary battery, SMT, Semiconductor, Automotive and Etc over 1,500 sets in worldwide.

# KOTRA | KOREA-Europe Battery Day

## SFA

World-Class equipment manufacturer with applications of AI(Artificial Intelligence) & Smart Factory Technology. SFA holds world's leading competitiveness in manufacturing equipment such as EV-battery, Transfer system of production line, Display panel, Flat glass, and Semiconductor.



### COMPANY HIGHLIGHTS

Name: SFA Engineering corp.  
Business areas: EV- battery manufacturing equipment, 3D CT Inspection machine, Logistics automation turn-key solution  
Headquarter: Hwaseong, South Korea  
Employees: 686 (Including all affiliates : 3,700)  
Revenue: €1,304 mil. (2020)  
Website: <https://www.sfa.co.kr/>



### PRODUCT PORTFOLIO

Products



### EV-Battery manufacturing Equipment & Battery logistics automation solution

- Able to execute large turn-key projects of EV-Battery manufacturing line
- Provide optimal stacking process total solution by connecting with stacking equipment and non-destructive 3D CT inspection machine
- Application of extremely difficult level of flexible display thin film handling know-how with the world highest delivery performance
- Exterior appearance inspection machine that can be applied to all type battery appearance inspection
- Degassing machine to prevent gas explosion in cells and complete the final shape

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : Samsung SDI , SK Innovation , LG Energy solution , EVE , BEST

Business Relationships : SFA has a record of carrying out numerous large-scale projects, including logistics automation systems, process, and Inspection equipment for efficient operation of EV-Battery manufacturing lines with EV-battery players.

### TECHNOLOGY HIGHLIGHTS

- Experienced in over 800 logistics system and equipment projects, and over 180 logistics consulting services
- Developed world's 1st AI exterior appearance inspection machine that can be applied to all types of battery inspection which can ensure Inspection accuracy and high Inspection stability close to 100%
- Possible to provide high productivity stacking equipment of 0.5 sec/sheet for short width, 0.7 sec/sheet for long width
- 3D CT for high-speed inspection of mass production lines (@2corner / Up to 15ppm)
- Prompt A/S response through SFA Europe Corporation(Hungary)

# BATTERY PRODUCTION PARTS

# KOTRA | KOREA-EUROPE BATTERY DAY

## CASTMAN

Company specializes in high-quality die-casting process engineering with technical experience accumulated over 10 years.



### COMPANY HIGHLIGHTS

**Name:** Castman Co., LTD.  
**Business areas:** Cu & brass die-casting, salt core casting, aluminum die-casting  
**Headquarter:** Suwon, Gyeonggi, South Korea  
**Employees:** 18 (2020)  
**Revenue:** €240 mil. (2019)  
**Website:** <http://www.castman.co.kr/overview/>



● Headquarter

● Sales, R&D, Production

### PRODUCT PORTFOLIO



#### Copper/Brass die-casting

- Cu: rotors, heat sinks for supercomputers, battery modules for e-ship
- Brass: crescent seal in hydraulic pump
- Optimized design, Development of surface treatment technology for die life extension



#### Salt Core casting (Al alloy)

- EGR (Exhaust Gas Recirculation), water/turbo pump housing, oil pump case, resonator wheel
- High design freedom, cost reduction,, improved reliability and lower weight



#### Aluminum die-casting

- Various types of connectors in EV, spools in seat belt, heat sinks

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

**Main Customers:** Hyundai-Kia Motor Group, Hyundai Mobis, LS Cable & System, FURSYS

**Business Relationships:** Hyundai-Kia motor group/Supply chain/Al die-casting products for Hyundai's vehicles

### TECHNOLOGY HIGHLIGHTS

- With a project support from Korean government, Castman developed Korean first cast temperature controller through coolant flow rate control. (2014)
- Developed integrated Cu die-casting machine first time in Korea and localized the technology.

# KOTRA | KOREA-Europe Battery Day

## EGTRONICS Co., Ltd.

EGTRONICS is a leading manufacturer for DC-DC converter of electric vehicle and we have been specializing in DC-DC converters for medium & heavy-duty vehicles for over 10 years. We're trying to make the DC/DC converter as smaller and lighter as possible since then. EGTRONICS have Chosen as a sole supplier for Fuel-cell Electric Trucks of Hyundai Motors.



### COMPANY HIGHLIGHTS

Name: EGTRONICS

Business areas: EV Power Transfer Device

Headquarter: Hwaseong-si, South Korea

Employees: 61

Revenue: € 12million(2020)

Website: <http://egtronics.com/>



### PRODUCT PORTFOLIO



- Very high efficiency (up to 98%)
- Compliance with European regulations (e Mark, CE)
- Galvanically Isolated
- ZVS (Zero Voltage Switching) topology ensures very low switching losses
- Fully Automotive compliant

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : Hyundai Motors, Arrival(UK), Samsung Electric and others

Business Relationships : Almost 5000 DC-DC Converter units were supplied to commercial vehicle manufacturer all over the world (Hyundai, Bozankaya, Sea Electric, Arrival and others) in last year (2020).

### TECHNOLOGY HIGHLIGHTS

- The DC/DC converter, a core product for the eco-friendly vehicle, is a product that is characterized by a total solution applicable from passenger use and commercial use and provides a customized service.
- We've been developing and manufacturing the DC/DC converter since 2008 and it means our technology has been proved during the period.
- Supply quantity of DC-DC Converter will be reached around 200,000units at 2025.

# KOTRA | KOREA-Europe Battery Day



## HWASHIN

Global automobile components manufacturer, Hwashin Co., Ltd Hwashin is an automobile chassis and body components manufacturer.

Hwashin that has been playing an important role in the Korean automobile components manufacturing industry by developing new technology based on its high quality products, services, and creative research is heading to the global market with its competitiveness through the state-of-the-art informatization system constructed with its young challenge spirit and outstanding technical skills.

### COMPANY HIGHLIGHTS

Name:	Hwashin Co., Ltd
Business areas:	Chassis and Body for Automotive
Headquarter:	Yeungcheon, South Korea
Employees:	4200(2020)
Revenue:	€1.3 Bil. (2020)
Website:	<a href="http://www.hwashin.co.kr">http://www.hwashin.co.kr</a>



### PRODUCT PORTFOLIO

Products



#### Chassis & Body(Battery Pack Case) for Automotive

- Secure, cost-competitive battery pack case for customer needs
- expanding the role of its research center by contributing to mass production of eco-friendly finished automobiles with the light materials, material diversification, and optimized design.
- Striving for mass production of eco-friendly finished automobiles with light materials, material diversification, and optimized design.
- In-house testing facility for products

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers :	Hyundai Motor Group, VW, AUDI, FORD, BYD, Renault NISSAN
Business Relationships :	THANH CONG/Joint Venture & Co-Development / Chassis production amount in Vietnam with capacity of Chassis (300,000 vehicles /year)

### TECHNOLOGY HIGHLIGHTS

- Hwashin, an automobile component development and manufacturing company, established the company-affiliated research institute 'Hwashin Technology Research Center' in August 1987.
- Hwashin Technology Research Center, composed of teams specialized in product design, computational interpretation, precedent study, test, prototyping, manufacturing line process design, and mold process technology development, is striving for research and development to maximize the abilities of technology research and product development.



# KOTRA | KOREA-Europe Battery Day

## INCELL Co.,Ltd.

Incell develops and produces lithium batteries based on its proprietary BMS and packaging technology to provide the most efficient Energy & Battery Solution Technology



### COMPANY HIGHLIGHTS

Name: INCELL Co., Ltd.

Business areas: ESS, Lithium battery, Renewable energy, Electric

Headquarter: Gwangju, South Korea

Employees: 60 (2020)

Revenue: 30,330,882 USD (2020)

Website: www.incell.kr



### PRODUCT PORTFOLIO



### LIB system (Lithium-ion Battery System)

- Excellent safety
  - Using ESS-only cells
  - Module and rack design to prevent fire spread
- High efficiency and longevity
- Application : ESS, Industrial, Commercial, Telecommunication (UPS, Backup, Data center ...)  
Mobility (AGV, E-forklift, EV, E-boat ...)  
Customize (Medical device, Robot ...)
- Certification : CE, IEC62619, UL1973

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : SAMSUNG, DOOSAN, Tomen device, PEC technology, Hörmann ...

Business Relationships : Product development

Participate in Government Project

Entry into overseas markets

### TECHNOLOGY HIGHLIGHTS

- INCELL has developed ESS based on its own BMS, battery packaging and safety technologies, and has been providing customers with the safest and most efficient ESS solutions.
- INCELL ESS is produced and packaged based on Samsung SDI's high-performance cells.
- From kWh to MWh



# KOTRA | KOREA-EUROPE BATTERY DAY

## Inzi Controls

Inzi controls offers diverse solutions for the field of automotive, especially in themes of thermal management systems, Battery case for xEV and Engineering plastic components such as Cylinder Head Cover, Air Cleaner and Valve body cover



### COMPANY HIGHLIGHTS

**Name:** Inzi Controls  
**Business areas:** Automotive Thermal Management System, Electrified Mobility Solutions, Lightweight Engineering Solutions  
**Headquarter:** Siheung, South Korea  
**Employees:** 543 (2020)  
**Revenue:** €5.8 mil. (2020)  
**Website:** <http://en.inzi.co.kr/>



### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

**Main Customers:** Hyundai-Kia Motor Group, Hyundai Mobis, Mando, GM, Toyota, VW, Audi, Renault  
**Business Relationships:** Partnership (with GM, supplies multi-valve), Partnership (with Hyundai motor group, supplies TMS and EP)

### PRODUCT PORTFOLIO

**TMS (Thermal Management System)**

- Thermostats, Thermostat housing assembly, Electric thermostat, Coolant control valve, Coolant temperature sensor, etc.

**Sensor/Valve/Actuator**

- Fuel pressure regulator, Pressure relief valve, Temperature sensor, Vacuum actuator, etc.

**EP (Engineering Plastic)**

- Cylinder Head Cover, Air cleaner, Air intake manifold, Valve body cover

Products

### TECHNOLOGY HIGHLIGHTS

- Self developed coolant control valve, applied in BEV, FCEV, ICE.
- Investing more on development of vehicle electrical units

# KOTRA | KOREA-EUROPE BATTERY DAY

KEC

Company offers a broad portfolio of power discrete devices for reliable, robust and power efficient automotive, industrial and consumer applications, including MOSFET, IGBT, SiC, GaN, diodes and BJT. Especially KEC's Small Signal Transistor holds world 2<sup>nd</sup> and Asia 1<sup>st</sup> supply rate.



## COMPANY HIGHLIGHTS

**Name:** KEC Corporation  
**Business areas:** Automotive (Hardware), Consumer goods (home appliances), Audio/Video and LED Lighting  
**Headquarter:** Seocho, Seoul, South Korea  
**Employees:** 1,922 (2019)  
**Revenue:** €146.5 mil. (2019)  
**Website:** <https://www.kec.co.kr/?lang=eng>



## PRODUCT PORTFOLIO



### LV MOSFET

- Operates in low voltage area (4V), therefore 50% wider safety area. Low on-state resistance (55mΩ @ 4.5V/ 110mΩ @ 2.5V)



### 650V IGBT

- High efficiency IGBT for 4<sup>th</sup> generation, more than 50% upgraded current efficiency, 50V higher blocking voltage than former IGBTs, higher junction temperature (175°C)



### Small Signal Transistor (SSTR)

- Transistor, produced with KEC's traditional technology. Stable performance in high temperature and voltage, junction temperature (150°C), drain-source voltage (60V) and fast switching time (15 nsec turn on)

## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

**Main Customers:** Tesla, LG Innotek, LG Chem, Hyundai, Hyundai Mobis, Sony, Panasonic, Philips

**Business Relationships:** LG Chem/Co-Development/BMS Diode Module (BEV), Hyundai Mobis/Co-Development/Power Module

## TECHNOLOGY HIGHLIGHTS

- KEC clinched a supply deal with Tesla and from 2021 KEC would provide them with LV MOSFET, applied in digital cockpits. Supply is expected to increase continuously until 2025 with Tesla's production plan (5 million/year)
- KEC signed Power Semiconductor IGBT foundry contract with CSMC of China in 2018 and through this contract KEC secured productive capacity based on the state-of-art technology.
- Strengthened LV MOSFET line-ups & increased HVAC business area, which is crucial for BEV & FCEV in air flow inside and outside of vehicle and air circulation in cabin room.

# KOTRA | KOREA-Europe Battery Day

## KORENS

KORENS is Global Tier 1 Automotive supplier of thermal management system for FCEV and EV. USA and Europe are main supplier of customer which is over 70% of total sales.

**KORENS**

### COMPANY HIGHLIGHTS

Name: KORENS  
Business areas: Automotive  
Headquarter: Yangsan, South Korea  
Employees: 891 (2020)  
Revenue: € 37mil. (2020)  
Website: <http://www.korens.co.kr>



### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : BMW, Ford, Hyundai, Kia

Business Relationships :

1. Co-Development FCEV TMS system for passenger car and commercial car
2. Largest Production : USA – 160K/year  
Germany - 10K/year  
China – 10K/year

### PRODUCT PORTFOLIO



#### Parts of FCEV, EV and EGR Module

- Thermal Management System (4Way Valve, 5Way Valve, Ion Filter)
  - Control Coolant Distribution, Temperature and Conductivity
- Air Processing System (Humidifier, APC, ACV)
  - Supply air into Fuel Cell Stack, Control pressure and moisture
- Coolant Control Product (Water Pump, 3, 4, 5Way Valve)
  - Control the coolant flow and direction
- Smart Coolant Control Product (Active Coolant Control Valve)
  - Automatically control the coolant flow
- Module Product
  - VPM (Valve & Pump Module) : Valve, Pumps, Reserve, Controller
- EGR Module contribute to a more eco-friendly car industry by helping to reduce exhausts

### TECHNOLOGY HIGHLIGHTS

- Korens Inc. has built a factory in Yangsan, Busan and Alabama. In case of Busan factory, it has established to smart factory on a scale of 9,917m<sup>2</sup>. Currently, KORENS is growing up in fuelcell market and is co-working with global customer for TMS system development. Those systems will be launched from 2023
- KORENS has a global footprint with production in and total production capacity of 800K/year.

# KOTRA | KOREA-Europe Battery Day

## Lattron

Lattron uses high-precision NTC Thermistor devices to produce various types of temperature sensor. We manufacture and sell temperature sensors for EV, HEV, BMS and ESS as well as for existing home appliances, industries and provide products with high reliability, stability and precision that enable customers to use the product for a long period of time through custom-made products.



### COMPANY HIGHLIGHTS

Name: LATTRON CO., LTD

Business areas: Electronic component

Headquarter: Daejeon, South Korea

Employees: 98(2020)

Revenue: USD 17 mill(2020)

Website: www.lattron.com



### PRODUCT PORTFOLIO

Products

- NTC Thermistor sensor for Automobile
- Sensors are equipped with Lattron's excellent thermistor element.
- Sensors offer high stability, high reliability and high precision.
- Variation of shape, size, and element type is available upon customer's request
- Application ESS type Balance Module, sensor for Automobile
- Development of enhanced devices for water permeation

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : SAMSUNG SDI, LG Chem, SK Innovation, Hyundai motors

Business Relationships : sales & co-development/ Largest NTC Thermistor production amount in Korea with capacity of NTC Thermistor (30KK/M), NTC thermistor sensor & balancing module (400K/M)

### TECHNOLOGY HIGHLIGHTS

- Lattron has factory in Korea, China and can respond from NTC thermistor element to NTC Thermistor sensor, balancing. Lattron plans to build a factory in Vietnam of Film heart , NTC Thermistor sensor and is scheduled to be completed in 2025.
- the 1st biggest firm in Korea in associated with manufacturing and market share relative of NTC thermistor products.

# KOTRA | KOREA-EUROPE BATTERY DAY

Misum Systech

Misum Systech is specialized in developing and manufacturing battery management systems, battery packs, energy storage systems and testing equipment.



## COMPANY HIGHLIGHTS

**Name:** Misum Systech  
**Business areas:** Module assembly, BMS design & inspection, battery pack design & testing  
**Headquarter:** Anyang, Gyeonggi, South Korea  
**Employees:** 50 (2020)  
**Revenue:** €7.7 mil. (2020)  
**Website:** <http://www.misum.co.kr/en/>



● Headquarter

● Sales, R&D, Production

## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

**Main Customers:** LG Chem, Samsung SDI, SK Innovation, Mando, ATL  
**Business Relationships:** Taiwan Corporations/Co-Development/Supply Battery pack and BMS in manufacturing e-tuk-tuk (Taiwan's traditional transportation)

## PRODUCT PORTFOLIO



### Battery Management System (BMS)

- Consumption current is less than 50μA during power-off mode to prevent battery damage due to discharge during long term storage and transportation
- BMS consumption current is less than 50% compared to the competitors.



### Battery Pack

- Current load balancing design is applied for individual cell to approach the average cell lifetime.



### Test Equipment

- Function tests and calibration of BMS
- Battery softpack and pack tests

## TECHNOLOGY HIGHLIGHTS

- With Thailand local corporations, MOU for co-development in 2019 for a project "E-Tuk Tuk" (Thailand's national remodelled 3-wheel motorcycle). Thailand government is planning to supply 22,000 until 2025 and also to export to southeast asian market.

# KOTRA | KOREA-Europe Battery Day

## MPS Korea Co.,Ltd

Since the establishment in 2002, MPS Korea has become a venture capital firm, an Ino-biz company, and has been selected as a G-Star company.

- Professionally certified quality management system that meets international standards such as ISO9001, ISO14001, and GMP13485
- Main business fields: lithium battery pack, Golf carts and related parts and related parts, manufacturing components
- Our company handles everything from product design to Maintenance with international standards by accredited institutions



### COMPANY HIGHLIGHTS

Name: [MPS Korea Co.,Ltd](#)

Business areas: [Lithium-ion battery packing manufacturer.](#)

Headquarter: [Yongin-si, Gyeonggi-do, Korea](#)

Employees: [35\(2020\)](#)

Revenue: [\\$970\(2020\)](#)

Website: [www.e-mps.co.kr](#)



● Headquarter

### PRODUCT PORTFOLIO



Lithium-ion battery pack

- Concept: Lithium-ion battery pack that can be installed in a wide range of applications from stationary UPS devices to electric vehicle
- Technology: State of art battery pack technology including battery cell balancing and BMS board and positioning
- Customer: Country clubs and EV companies

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : Toyota, Rakuten, golf course. etc

- Business Relationships :
- (Domestic): Golf cart-Golf course (80 golf course), Medical scooters-Agency (100 agency), Lithium battery ( National network )
  - (Export): Japan (lithium battery pack and golf cart / parts)

### TECHNOLOGY HIGHLIGHTS

- No-soldering bolting method
- Assembly type pack production method
- Customizable production
- Variable voltage / capacity
- Ensuring safety
- Overcharge protection
- Undervoltage lockout
- Overcurrent shutdown
- CAN communication
- SOC / SOH estimation
- Temperature control
- Intercell Balancing Function
- Grouped cell protection

# KOTRA | KOREA-Europe Battery Day

## PowerPlaza

Manufacturer of the first electric conversion truck "PEACE" 0.5ton in Korea. Established in 1993 with electronics technologies background, develop & manufacture 700kinds of industrial SMPS, power supplies. Power Plaza has expand business range to Electric Vehicle since 2007 and have certified E-conversion truck in 2014 Korea and started local sales. We have a experience not only all EV related electric parts but also lithium ion battery modules. develop own vehicle chassis design



### COMPANY HIGHLIGHTS

Name: Power Plaza Co.,Ltd

Business areas: Dc-dc converter, Lithium ion battery module,

Headquarter: Seoul, South Korea

Employees: 53

Revenue: €522mil

Website: [www.powerplaza.com](http://www.powerplaza.com)



### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : CRG Spa, Linde MH

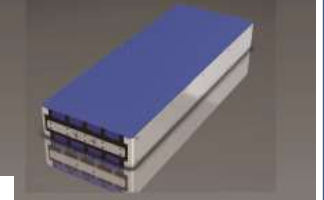
Business Relationships : Partnership with Linde MH, LG Chem Korea

### PRODUCT PORTFOLIO

Products

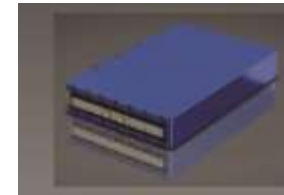
#### Battery Module LBLI 110V / 32A

Energy(kWh)	3.52
Max Discharge Current (A)	100
Max Charge Current (A)	31 (1.0C)
Cycle (90%DOD)	1,000
Operating Temperature(°C)	-20~60
Dimension (L*W *H) (mm)	600*215.4*72



#### Battery Module LBLI 81V / 45A

Energy(kWh)	3.62
Max Discharge Current (A)	140
Max Charge Current (A)	43.4 (1.0C)
Cycle (90%DOD)	1,000
Operating Temperature(°C)	-20~60
Dimension (L*W *H) (mm)	463.5*282.5*73.8



#### Battery Module LBLI 51V / 32A

Energy(kWh)	1.64
Max Discharge Current (A)	100
Max Charge Current (A)	31 (1.0C)
Cycle (90%DOD)	1,000
Operating Temperature(°C)	-20~60
Dimension (L*W *H) (mm)	300*217*73



### TECHNOLOGY HIGHLIGHTS

- Power Plaza have proven its high performance with own designed e-vehicle Yebujana, e-conversion truck PEACE since 2009.
- Yebujana has done Europe tour of Zero Race 2010 and set Korea Guinness Record as 503km in division of EV's longest drive range. PowerPlaza has done over 1000km cross country tour with electric vehicles on 2011.



# KOTRA | KOREA-EUROPE BATTERY DAY

## Sungwoo Hitech

Company is developing new technologies to evolve into a future technology innovation leader in global automobile market. The company has 27 production facilities in 7 countries.



### COMPANY HIGHLIGHTS

**Name:** Sungwoo Hitech  
**Business areas:** Eco-friendly vehicle components, car body, autonomous driving sensors  
**Headquarter:** Yangsan, Gyeongsang, South Korea  
**Employees:** 18000 (2020)  
**Revenue:** €930 mil. (2020)  
**Website:** <https://www.swhitech.com/eng/>



### PRODUCT PORTFOLIO



#### Battery Pack

- Battery case assembly (protects cells and systems), battery module assembly (efficient storage of cells), battery system assembly (Efficient energy supply to battery)



#### Hydrogen Tank

- TYPE 4: plastic liner & carbon-fiber winding forming technology applied; able to withstand high pressure (700 bar) and low/high temperature (from -40°C to 80°C) at charging/discharging; block/supply of hydrogen gas by electrical signals



#### Autonomous Driving Sensors

- LiDAR (light detection and ranging) for precise positioning & FIR (far infrared) for night vision system

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

**Main Customers:** Hyundai-Kia Motor Group, GM Korea, VW, BMW  
**Business Relationships:** Hyundai-Kia Motor Group/ Co-Development/Support from Hyundai in strengthening R&D capability

### TECHNOLOGY HIGHLIGHTS

- Company has participated in the platform design project for two EV programs.
- Sungwoo Hitech offers also various R&D activities in the simulation, body in white, testing & evaluation, as well as forming and joining technologies.

# KOTRA | KOREA-Europe Battery Day

## SWECO INC.



SWECO is a technically modern manufacturing company producing a wide range of electrical insulation products, located in Korea. SWECO is the only Korean manufacturing organization producing a broad range of electrical insulating materials to international standards and safety certification, which includes ISO 9001 and IATF16949.

### COMPANY HIGHLIGHTS

Name:	SWECO INC.
Business areas:	Insulating Materials
Headquarter:	Hwaseong, South Korea
Employees:	104 (2020)
Revenue:	21.4 mil. (2020)
Website:	<a href="http://www.swecomica.com/eng/default.asp">http://www.swecomica.com/eng/default.asp</a>



### PRODUCT PORTFOLIO



#### New insulation product for ESS and EV Batteries

- Our product has a thermal conductivity feature that is about 5 times lower than that of a mica plate.
- At the same time, it has 4 times lower weight compared to the mica version
- 3D Shaped insulating

Products



### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : Valeo, Borgwarner

Business Relationships : Working on with advanced development departments in secondary battery manufacturers such as LG Chem, SK Innovation, Samsung SDI, SolarEdge.

### TECHNOLOGY HIGHLIGHTS

- Cell to Cell Insulation
  - In case of CAN type battery, when applying our product, it is expected to pass battery propagation test with 0.7~1.5mm thickness
  - In case of POUCH type, various verifications are required with a thickness of at least 2.5mm
- Pack Barrier Insulation
  - Our SIM is thermally conductive and easy to process, making it easier to install than thick and heavy mica plates.

# KOTRA | KOREA-Europe Battery Day

## Youngsin Metal Industrial Co.,Ltd

YoungSin is specialized in production of Fastener and currently expanding our field of specialization to precision processing based on know-how on fasteners to become a widely recognized global enterprise.



### COMPANY HIGHLIGHTS

Name: Youngsin Metal Industrial Co.,Ltd  
Business areas: FASTENER(Connecting, Cold Forging)  
Headquarter: Seoul, South Korea  
Employees: **430 (2020)**  
Revenue: 110 Million USD  
Website: <http://www.ysmic.com>



### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : HYUNDAI, KIA, GENERAL MOTORS, MAGNA, LG Chem

Business Relationships : Automotive manufacturers, Electronics

### PRODUCT PORTFOLIO

#### Insert / Rivet / Screw for Battery

Products



### TECHNOLOGY HIGHLIGHTS

- YoungSin is specialized in production of Fastener such as bolt, screw and precision forged parts since establishment, supplying specialized products in 12,000 species in overseas and local market and has been certified for quality and technology from consumers.

In particular, we are operating all process in house to serve the best products.

- YoungSin has a global footprint with production sites in 2 country(R.O.KOREA, THAILAND) and 4 warehouse in EUROPE(NETHERLAND, ITALY, POLAND), NORTH AMERICA(USA).

# KOTRA | KOREA-EUROPE BATTERY DAY

## YURA

Company is specialized in electrical components for vehicle manufacturers, such as automotive electric and electronic distribution system wiring harness, HV junction box and BFA. Yura Corporation is an exclusive supplier of its built-in camera modules to Hyundai Motor.



### COMPANY HIGHLIGHTS

<b>Name:</b>	Yura Corporation
<b>Business areas:</b>	Electrical components (automotive electric and electronic distribution system wiring harness, HV junction box, BFA, etc.)
<b>Headquarter:</b>	Seongnam, Gyeonggi, South Korea
<b>Employees:</b>	25,000 (2020)
<b>Revenue:</b>	€1.3 bn. (2019)
<b>Website:</b>	<a href="https://www.yuracorp.co.kr/en/index.jsp">https://www.yuracorp.co.kr/en/index.jsp</a>



### PRODUCT PORTFOLIO



#### Wiring Harness

- Development of various wiring harnesses, which is a key component in sending and receiving signals in vehicle systems.
- Main wiring harness, front wiring harness, control wiring harness, floor wiring harness, door & roof wiring harness



#### Gateway integrated central control unit

- Operating voltage: DC 8V – 16V
- Operating temperature : -35°C – 75°C



#### High Voltage Electric Vehicle Junction Block

- Operating voltage: DC 240V – 450V
- Operating current: max. 200A DC
- IP Rating: IP 67

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

<b>Main Customers:</b>	Hyundai-Kia Motor Group, Hyundai Mobis, BMW, VW
<b>Business Relationships:</b>	Hyundai-Kia Motor Group/Co-Development/Wiring Harness, Hyundai Mobis/Co-Development/Battery systems

### TECHNOLOGY HIGHLIGHTS

- 1<sup>st</sup> generation built-in camera had been already applied in Hyundai's Sonata from 2019 and this is Yura Corporation's exclusive supply.
- From 2023 Yura Corporation's 2<sup>nd</sup> generation built-in camera would be integrated in Hyundai's vehicles. With wide range of update of image quality and UI, it would be more convenient for customers to use.
- Yura Corporation's R&D capability is remarkable, i.e. 1/3 of employees are working in R&D

EV CHARGER

# KOTRA | KOREA-Europe Battery Day

## Daeyoung Chaevi Co., Ltd.

CHAEVI provides solutions for using eco-friendly energy in various industrial sites by manufacturing smart moving chargers for distribution centers, bus chargers, In addition, we provide solutions for using eco-friendly energy in various industrial sites by manufacturing smart moving chargers for distribution centers, bus chargers, and Ultra-fast chargers.



### COMPANY HIGHLIGHTS

Name: Daeyoung Chaevi Co., Ltd.

Business areas: World wide

Headquarter: Daegu, Korea

Employees: 170

Revenue: \$ 38,000,000

Website: www.Chaevi.co.kr



### PRODUCT PORTFOLIO

Products



- Product line up: 3kW ~ 400kW
- Charging type : CCS1, CCS2, CHAdeMO, SAEj1772, IEC 61851 (all standards in the market)
- Communication: PLC, LAN, OCPP 1.6~2.0, RS-485 & 232, ISO13118, DIN70121 and Etc.
- OS : Window 10 with customized UI.
- Safety Function : Overvoltage detection, Temperature sensor, Leakage detection, Emergency Stop and etc

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : Car Manufacturers

Business Relationships : Confidential

### TECHNOLOGY HIGHLIGHTS

- Ultra-Fast EV chargers up to 400kW with PnC
- Optimizing communication protocol for all vehicles. The solutions for using eco-friendly energy in various industrial sites by manufacturing smart moving chargers for distribution centers, bus chargers, and Ultra-fast chargers.

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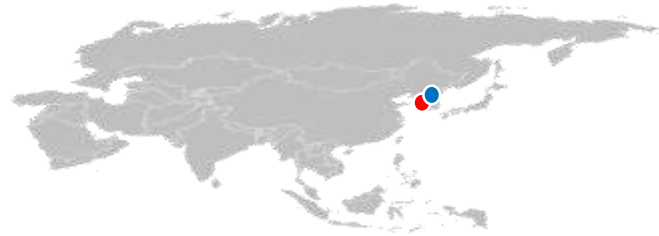
## MODERNTEC

Company is specialized in manufacturing of industrial automation and machine tool control systems. In 2017 Moderntec introduced an innovative charging station, which is connected with photovoltaics ESS and developed as „cabinet“ to reduce installation space.



### COMPANY HIGHLIGHTS

<b>Name:</b>	Moderntec
<b>Business areas:</b>	Machine tool control system, industrial automation systems, EV charging system (ESS compatible, G2V, V2G, etc.)
<b>Headquarter:</b>	Changwon, Gyeongsang, South Korea
<b>Employees:</b>	32 (2019)
<b>Revenue:</b>	€7 mil. (2019)
<b>Website:</b>	<a href="https://www.moderntec.kr/home-1">https://www.moderntec.kr/home-1</a>



● Headquarter

● Sales (KR), R&D (KR), Production (KR)

### PRODUCT PORTFOLIO



#### “Smart” EV Charging System

- EV Charging System, connected with PV ESS and developed in „cabinet“ concept, reducing installation space (50% of installation cost reduction). It consists of “Master Kiosk” and “Charge Kiosk” with optimized electric distribution, showing high energy efficiency (saving up to 1/4 energy) and faster charging time (up to 30%)



#### Machine Tool Control System

- Development and supply of control systems for middle to big size machine tools



#### Industrial Automation System

- Automation systems applied in production facilities, such as LCD PDP, vehicle engines and solar power, which show increased productivity

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

<b>Main Customers:</b>	Doosan Infracore, Hanwha, Samsung SDI (PDP ROBOT)
<b>Business Relationships:</b>	KEPCO (Korean Electric Power Corporation)/ Co-Development/ “Smart” EV Charging Station (2017)

### TECHNOLOGY HIGHLIGHTS

- World first “Smart EV Charging Station”, divided in power bank and dispenser, 50 dispensers could be connected to power bank, hence shows 50% of cost reduction for new infrastructure installation.
- In CES 2020 Moderntec showed world first autonomous charging robot. The robot moves along a rail, recognizes vehicle type, size and charging adaptor and plug charging adaptor automatically.

RECYCLING



# KOTRA | KOREA-Europe Battery Day

## Kapjin

KapJin is a Total Power Supply Technology Global Leader which improve products and services through the best level of technology development , based on Analog, Digital and Software technology, accumulated in power electronics and charger/discharger.



### COMPANY HIGHLIGHTS

Name: Kapjin

Business areas: Charger and Discharger, BPT, LVDC, PV/ESS/FC

Headquarter: Suwon, Gyunggi, South Korea

Employees: 121

Revenue: 57.3M USD(2020)

Website: <http://www.kapjin.co.kr/>



### PRODUCT PORTFOLIO

Products



- Charger and Discharger  
Equipment used in Formation process for activating and testing



- Battery Tester (Cycler)  
Evaluate long-term characteristics of Battery (Lifecycle, Reliability)

### MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

Main Customers : Samsung SDI, SK Innovation. Hyundai Motors, Kokam etc..

Business Relationships :

Samsung SDI : Supplied of Charging/Discharging machine on the aging process of whole Lithium-Ion battery production line in Samsung SDI. (Rectangular/Cylindrical Cell)

SK Innovation : Supplied of Charging/Discharging machine on the aging process of whole Lithium-Ion battery production line in SK Innovation. (Pouch Cell)

### TECHNOLOGY HIGHLIGHTS

- The Equipment Test for checking xEV and ESS Battery efficiency and safety  
.A long term Characteristic Test for battery activation and activated battery  
.Overcharged, over-discharged Driving Test for battery safety and trust  
(Energy Revival driving way, when battery charges and discharges, through system power connection)
- Provide Medium and Large-Sized Charge and Discharge to Samsung SDI, SK Innovation(Global Lithium-ion battery makers) from 2015.

REPRESENTED BY SAMSUNG

Samsung C&T is one of major trading and Investment companies in Korea, which targets to become a part of integrated supply chain of Li-Ion battery in Global Market together with valuable LI-Ion battery partners from Korea.

## COMPANY HIGHLIGHTS

Name: SAMSUNG C&T CORPORATION

Business areas: TRADING & INVESTMENT

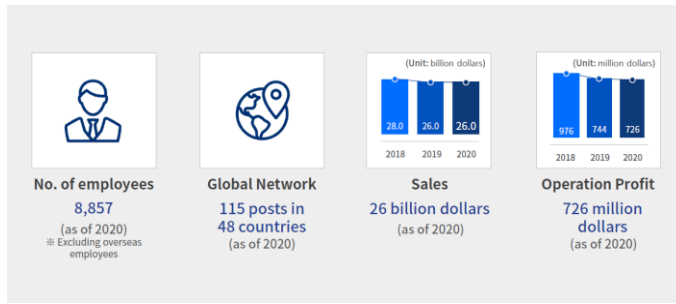
Headquarter: 123 OLYMPICRO 35GIL, SONGPAGU, SEOUL, 05510, KOREA

Regional HQ : SAMSUNG C&T DEUTSCHLAND GMBH (Am Kronberger Hang 8, 65824 Schwalbach, Germany)

Employees: 8,857 (as of 2020)

Revenue: \$26 Billion (as of 2020)

Website: www.samsungcnt.com



## PRODUCT PORTFOLIO - I

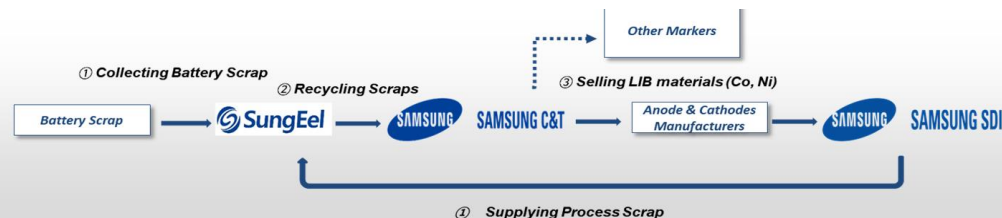
Products



**1. Cobalt Sulfate, Nickel Sulfate from recycling LIB scrap**  
 Samsung C&T invested in one of major Li-Ion Battery recycling plant, SungEel Hightech, to secure cobalt and Nickel supply as a responsible enterprise for environment. We are recycling Samsung SDI's LIB scrap in Korea, Hungary and Malaysia and willing to expand recycling plant in Europe, which will be main market for LI-Ion Battery. The recycled products, Cobalt & Nickel Sulfate is used for LIB cathode's main materials. We are currently under consideration to create a close-loop economy and cooperation in this growing EV battery market.

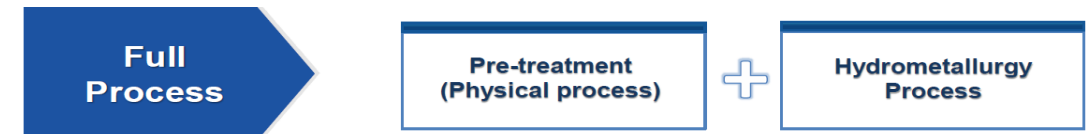
## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

We are recycling mainly Samsung SDI's LIB scrap and selling recycled products to SDI's cathode vendors in Korea and China in closed loop supply.



## TECHNOLOGY HIGHLIGHTS

- We are recycling 57,000MT of scrap per annum via pre-treatment plants in Korea, Hungary, Malaysia, China, India and US and produce approx. 7,000MT of Cobalt and Nickel with hydrometallurgy process, which makes no CO2 emission and extract various metal (Co, Ni, Li, Mn) relative to Pyro-metallurgical process.



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## PRODUCT PORTFOLIO - II



Products

### 2. Electrolytes for li-ion batteries

Samsung C&T promotes marketing and sales of Electrolytes manufactured by one of major electrolytes in Korea, Dongwha Electrolyte to potential customers in Europe. The electrolytes is charge in moving the Lithium Ion the lithium secondary battery for portable electronic devices like cell-phone, lab top, PDA & HEV/EV/PHEV.

The electrolyte producing plant, of 5,400 square metres, will supply Hungary and the region's battery manufacturers with Electrolyte.

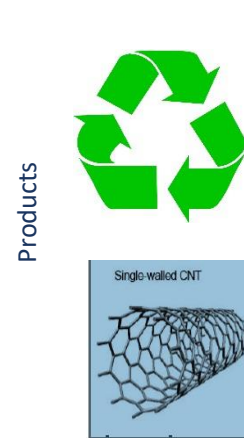
## TECHNOLOGY HIGHLIGHTS

- Electrolyte products are applied to most of battery lines and capacitor with various forms and purposes : high performance, high stability to battery makers
- Electrolyte producing plant (5,400 sqm) in Hungary is under construction and supply the region's battery manufacturers with electrolyte

## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

- Main Customers : Samsung SDI, SK Innovation, LG

## PRODUCT PORTFOLIO – III & IV



Products

### 3. NMP Recycling

Samsung C&T 's Partner (Dongwha) is constructing two facilities in the industrial park near the town of Sósút, HU. One facility will produce electrolyte and the other will recycle the solvent NMP.

### 4. CNT slurry

- Under developing

## TECHNOLOGY HIGHLIGHTS

- NMP recycling unit, occupying an area of 7,200 sqm, will contribute to sustainability in Europe's battery manufacturing

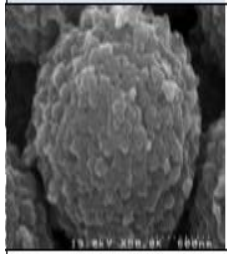
## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

- Main Customers : under developing in Europe

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## PRODUCT PORTFOLIO - V

### 5. Silicon anode powder



Products

Samsung C&T 's Partner (TERA TECHNO) produce silicon anode powder for high energy density and high speed charging with competitive cost.

This material is very interested in Battery makers or developpers, who are increasing production of silicon anodes to substitute the graphite anodes in lithium-ion batteries, as they look to address the demand for batteries with higher energy density.

## TECHNOLOGY HIGHLIGHTS

- highly efficient process utilizing the steel manufacturing process method
- It increase in productivity, profitability and performance

## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

- Main Customers : under developing in Korea, China and Europe

## PRODUCT PORTFOLIO - VI



Products

### 6. Test and diagnosis equipment for s EV battery

Samsung C&T's Partner (MinTech) has developed tool and system for testing and diagnosis of EV used battery, which enables the quick and accurate inspects/diagnosis/classify of the batteries state and performance of EV & Energy Storage Systems through conducting a complex diagnosis using a combination of various methods.

## TECHNOLOGY HIGHLIGHTS

- MinTech's diagnosis system has developep by using AC impedance method and it can be used for high voltage (1,000v) and wide range frequency (4kHz~0.05 Hz)
- It can save time and cost for EV used battery industry

## MAIN CUSTOMERS & BUSINESS RELATIONSHIPS

- Main Customers : : Hyundai / KIA motors / LG ES