솔루스 첨단소재
Solus Advanced Materials

Global No. 1 Material Solutions Partner

Solus Advanced Materials

솔루스 첨단소재
Solus Advanced Materials

Contents

솔루스 첨단소재
Solus Advanced Materials

Chapter 1.

Prologue

01. Company Overview

Future-oriented high growth portfolio on Battery Copper foil, Copper foil, Electro-materials, & Bio business secured

Company Introduction

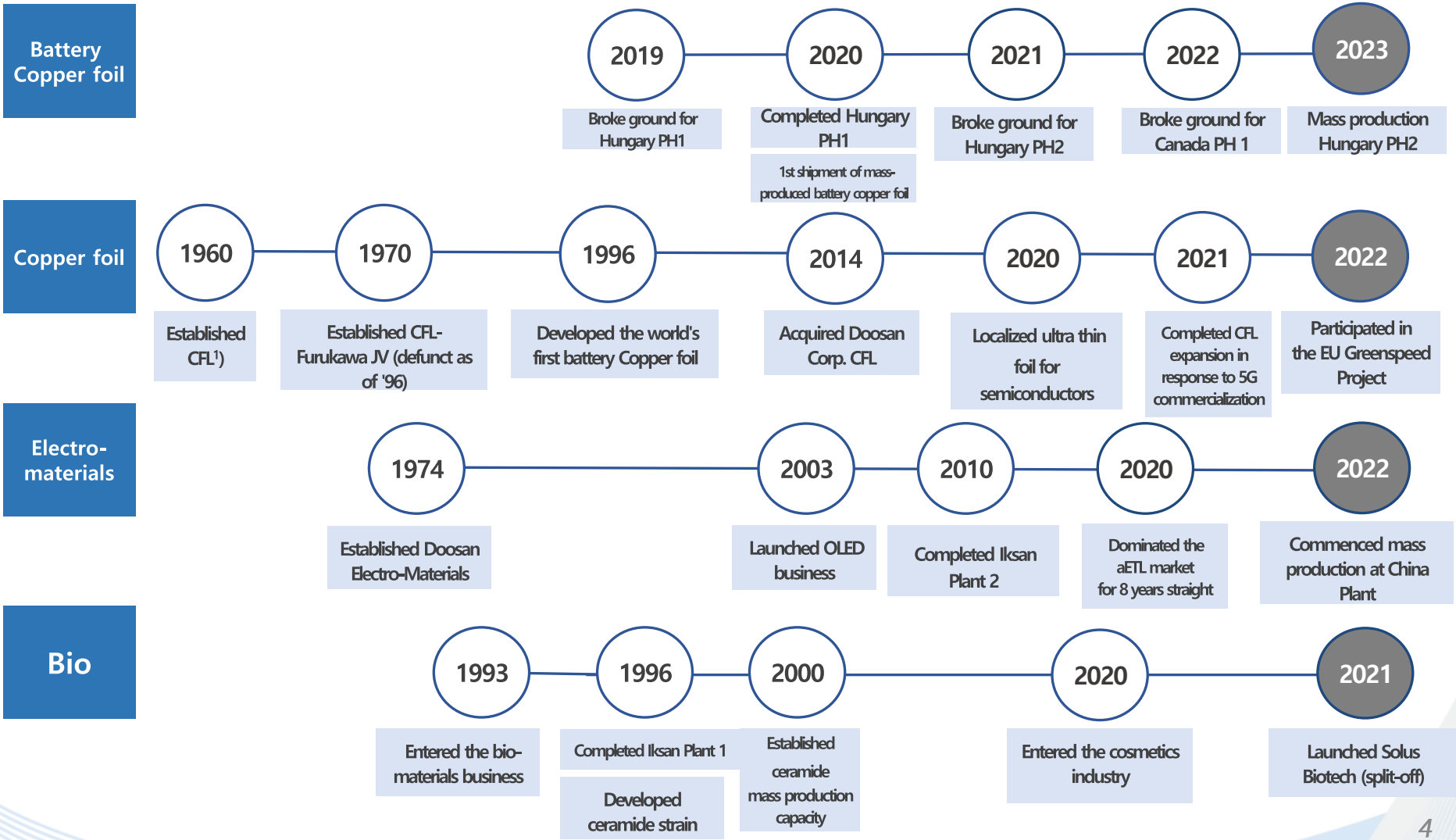
Company Name	**Solus Advanced Materials Co., Ltd.**
CEO	**Daeje Chin & Kwangpyuk Suh**
Established	**2019.10.01**
Listed	**2019.10.18 (KOSPI)**
Total Assets	**USD 1,182M (As of the end of Mar '23)**
Employees	**1,349 (As of the end of Mar '23)**
Sales	**USD 338 (As of the end of Dec 2022**
Based	**627 Seodong-ro, Iksan-si, Jeollabuk-do**
- Battery Foil	**Hungary, Canada (R&D/Production/Sales)**
- Copper Foil	**Luxembourg (R&D/Production/Sales)**
- Electro Materials	**Bundang(R&D/Sales), Iksan (Production), China (Production/Sales)**
Bio	**Bundang(R&D/Sales), Iksan (Production)**

Business Introduction

Battery Copper Foil Division	**Battery Copper Foil**	Core material for EV batteries	
	Copper Foil	Core material for communications and electronic circuit boards	
Advanced Materials Division	**Electro-Materials**	OLED and display materials for smartphone, TV, laptop, etc.	
	Bio	Natural-based materials for cosmeceutical, pharmaceutical and nutraceutical	

02. History

Business expansion & growth into global no.1 material company with over 60 years of experience & know-hows



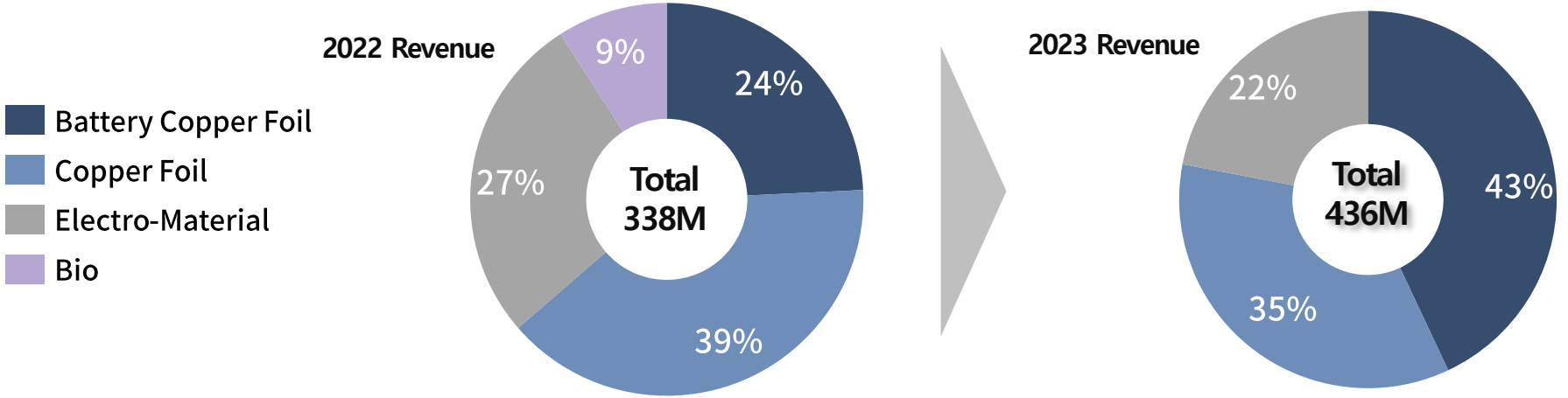
1) Circuit Foil Luxembourg

CREATE THE VALUE, CHANGE THE FUTURE

Based on cutting-edge technology that creates customer-value,
we connect 'Advanced Materials' and 'Innovative Solutions' to humanity for a better future

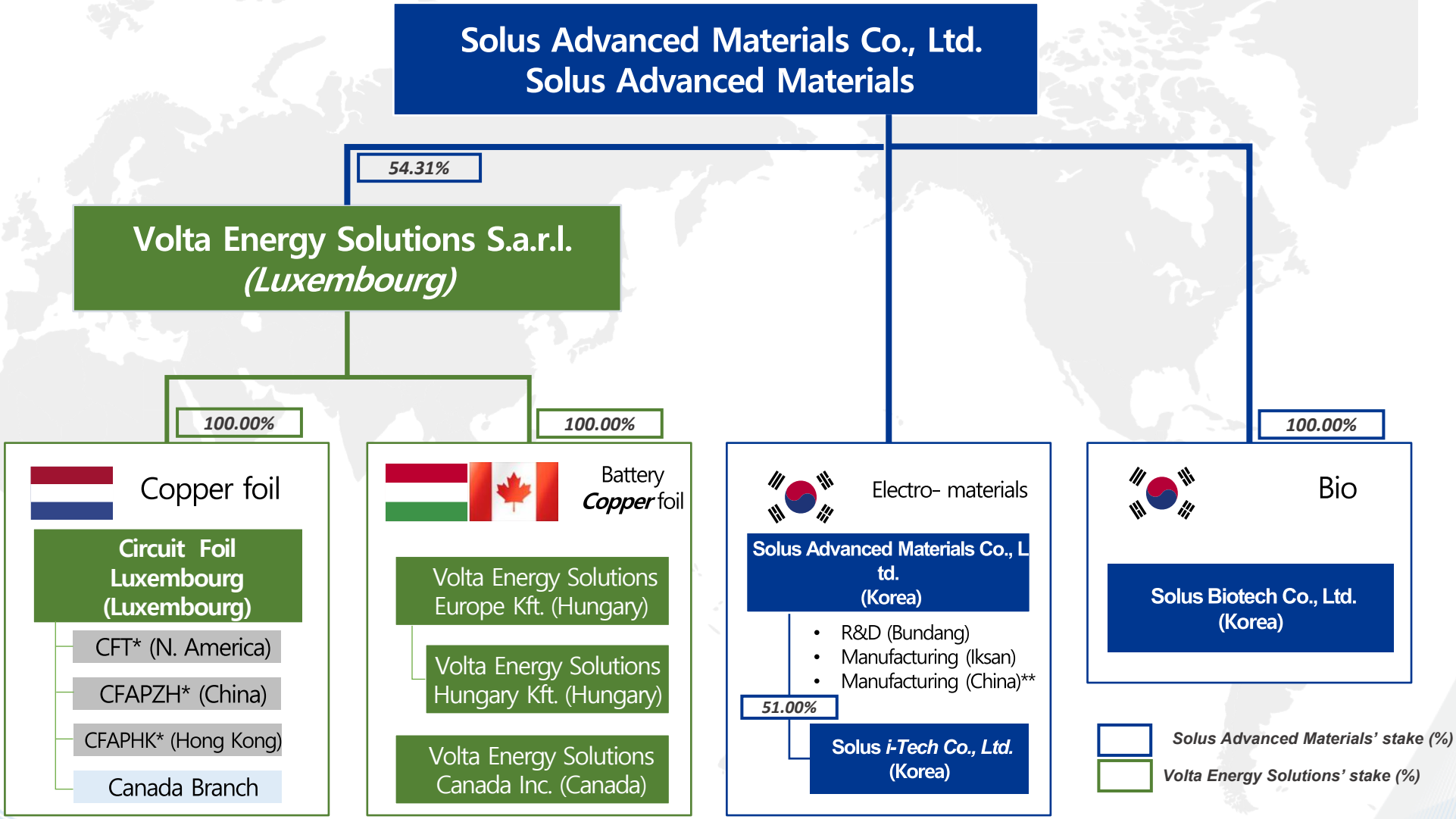
GLOBAL NO. 1 MATERIAL SOLUTIONS PARTNER

Takeoff as a global leading company in advanced materials with the aim of USD 436M by 2023



04. Company Governance

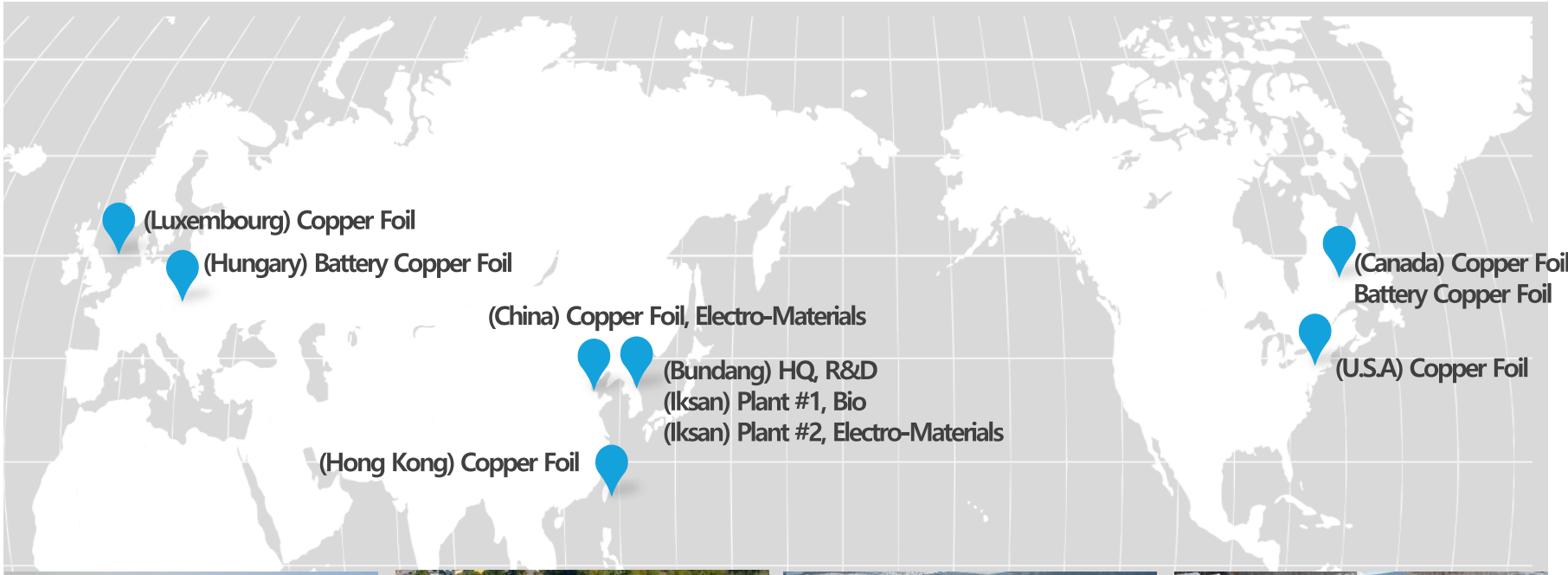
Multi-national business consisting of domestic and international corporations to secure global market



** CFT (Circuit Foil Trading Inc.) / CFAPZH (Circuit Foil Asia Pacific Zhangjiagang) / CFAPHK (Circuit Foil Asia Pacific Hong Kong)*
*** Solus Advanced Materials (Changshu) Co., Ltd.*

05. Site Locations

Manufacturing and selling Battery copper foil/Copper foil/Electro-Materials/Bio in 7 countries around the world



Iksan Korea (Electro-Materials & Bio)

Luxembourg (Copper Foil)

Hungary (Battery Foil)

Canada (Battery Foil)

06. Management Excellence

Management composed of top industry professionals with over 40 years of experience

Mr. Daeje Chin

- CEO, Solus Advanced Materials
- CEO, SkyLake Investment
- Endowed-chair Professor, KAIST
- Former Korean Minister of Information and Communication
- Former CEO, Samsung Electronics, Digital Media Group
- Former CEO, Samsung Electronics, LSI Group

Mr. Kwangpyuk Suh

- CEO, Solus Advanced Materials
- Former CEO, Polypia
- Former CEO, Tapex
- Former President of Technology Strategy Center, SK Hynix
- Former CEO, Core Logic Inc.
- Former CEO, Samsung Electronics, ASIC/Foundry Group

솔루스 첨단소재
Solus Advanced Materials

Chapter 2.

Core Competency

01. Business Highlights

02. Business Overview

- Battery Copper Foil
- Copper Foil
- Electro-Materials
- Bio

Business Highlights

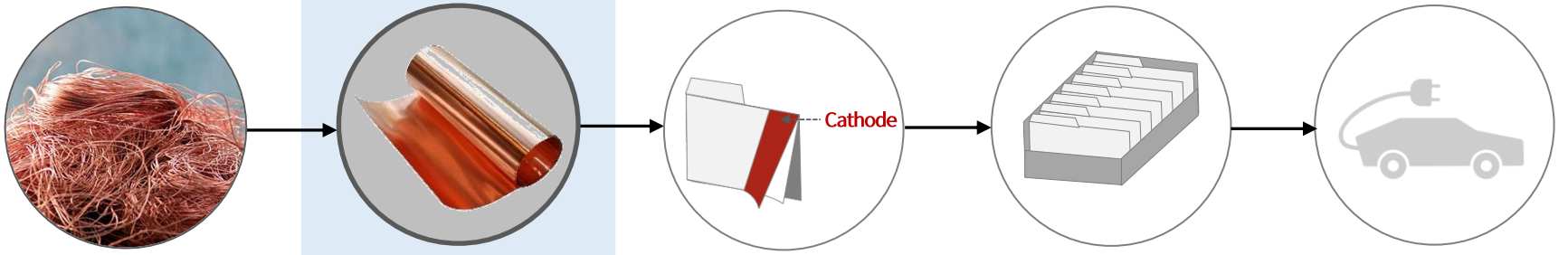
	Future growth business portfolio	Unique position in market	Ready to take off as global leader
Battery Copper Foil	2.8 times increase in demand for battery copper foils in 2027 due to higher demand for EVs worldwide	World's first battery foil producer with Europe's one and only battery foil plant	Step-by-step factory expansion to 119k ton production capacity by 2027
Copper Foil	AI·Robot·Network and ICT growth leading to steady growth of high-end copper foils	No.1 market share in high-end copper foil material within 5G field	Establish long-term supply system of high value product based on dominant technology
Electro-Materials	Expanded application of OLED in mobile/TV led to 1.4t times growth of the OLED market by 2027	Dominant aETL[1)] market position with OLED core material patents	Business portfolio expansion through organic material business, in addition to encapsulation film[2)] and QD market entry
Bio	Bio market expected to grow 1.7 times to 1.5 trillion in 2027	No.2 in global market share as Korea's one and only natural derived Ceramide manufacturer	Material value chain expansion through product diversification and by securing demand of major customers

1) Additional Electron Transport Layer (aETL): ETL which improves Blue layer efficiency by 30%
2) Encapsulation Film: Located above the OLED panel cathode, it blocks the penetration of oxygen or fluid that may damage the luminous material of the organic OLED

Battery Copper Foil Business Overview

Battery Copper foil(a type of copper foil) is a core material that forms the EV battery anode

Solus Advanced Material



Copper Strap

Battery Copper Foil

Battery Cell

Copper Foil +Graphite = Anode

Battery Module

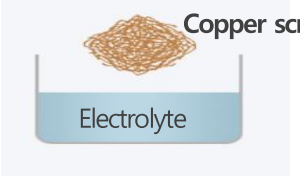
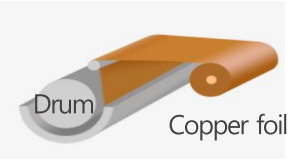
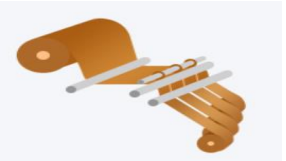
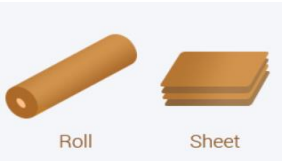
Certain number of battery cells assembled into a frame

Electric Vehicle

Battery module mounted with various supplementary systems

Battery Copper Foil Manufacture Process

4 Steps for Completion: Dissolving → Plating → Slitting → Inspection and Shipping

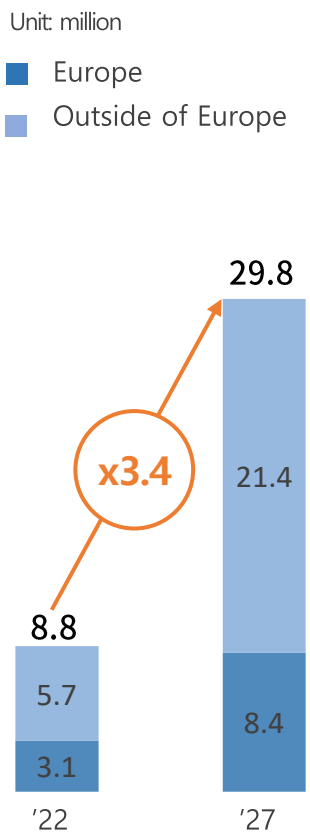
Dissolving		**Prepare electrolyte for plating by dissolving the raw material in electrolyte solution**
Plating		**Produce copper foil by plating Cu ion on drum in electrolyte solution**
Slitting& Sheeting		**Slit in width direction according to customer demand size**
Inspection & Shipping		**Pack and ship after strict quality inspection**

Ready to Take Off as Global Leader

Gradual expansion and establishment of new North American plant to meet new battery demands: Increasing production capacity for battery Copper foil

Global EV Market Outlook

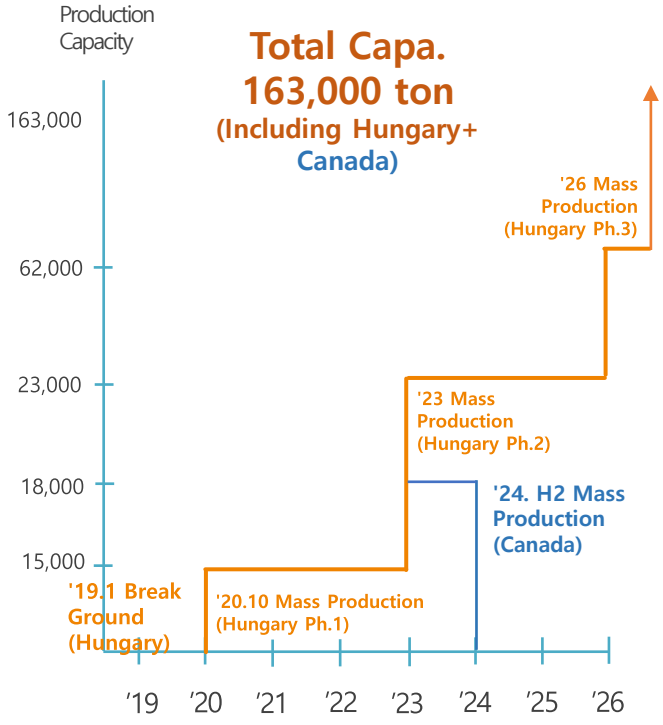
Unit: million



Source: SNE Research (BEV+PHEV)

Battery Copper Foil Production Capacity

Unit: ton , Gross Capa



Growth-Acceleration Strategy

Proactive step by step Capa. increase to meet battery customer demands in Europe & North America

- Europe (Hungary)

- Capa expansion in progress aiming to reach 100,000 ton by '26 [Phase 1(15,000 ton) / Phase 2(23,000 ton), Phase3(62,000 ton)]

- North America (Canada)

- Planning to build a plant in Quebec Canada for preemptive entry to North America market
- Mass production will start in the H2 of '24 [Phase1(18,000 ton)]

View of Hungary plant

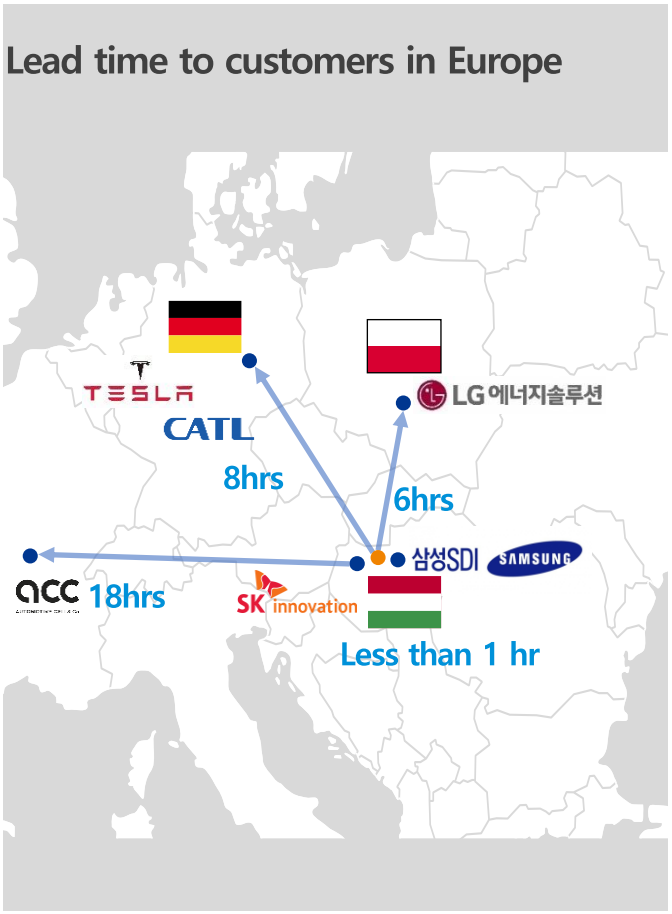
Existing Canada plant building

Secure stable supplies by long term supply agreement with major customers

Two-track supply to Europe & North America planned for existing customers

Unique Position in Market – Europe

Establish unparalleled position in market with Europe's one and only battery copper foil plant



Locational Advantage

Competitive edge in lead time

- Same-day shipping available for major customers
- Competitors need 5-7 weeks of lead time
  - Potential quality risks such as oxidization, deformation could be caused at long-distance shipping

Customer-focused support

- Real time technical support from local resident personnel
- Customer specific production line for certain volume order to be built

Customer Diversification

Secure Top-tier Customer

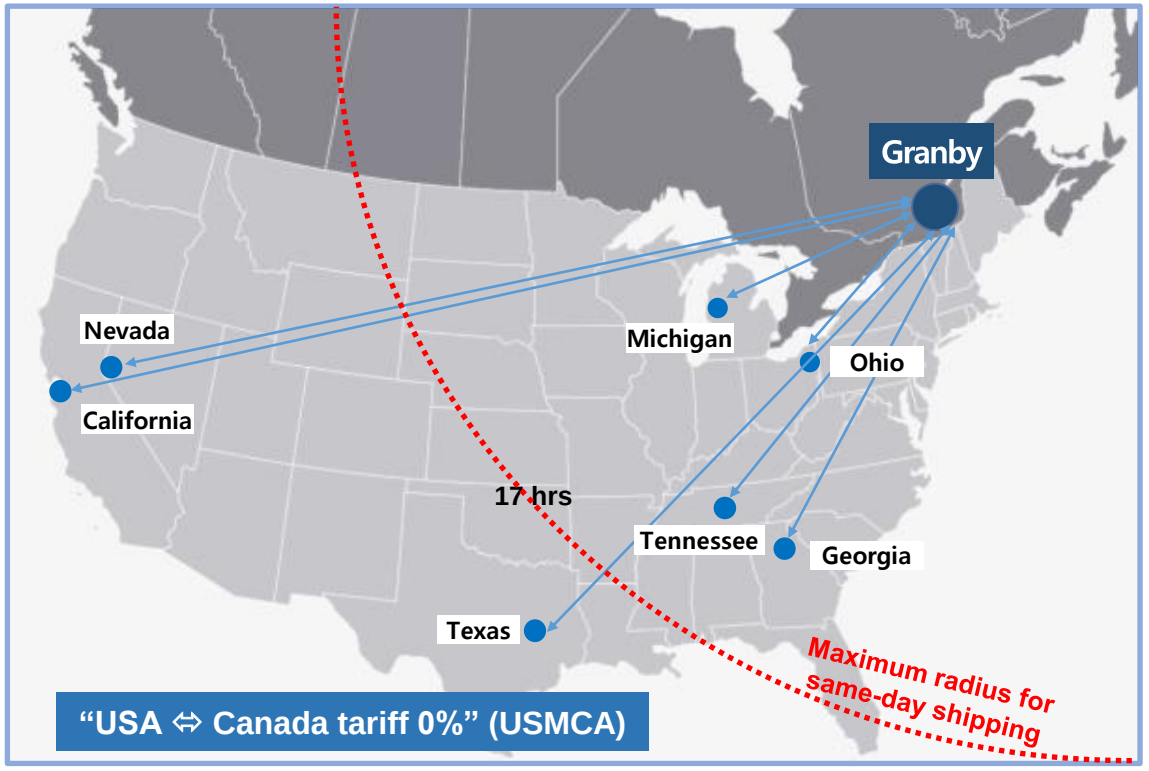
- Mid- to long-term supply contract with global top-tier battery manufacturer signed ('20)
- Mid- to long-term supply contract with global automaker signed

Supply contract with major customers in progress

Unique Position in Market – North America

Build Solus' first North America-based battery copper foil plant to dominate fast-growing EV market - secure real time support for major customers

Plant location and distance to customers in North America (hours)



Korea's first battery copper foil plant in North America

- **Competitive edge in lead time**
- **Real time support and customer intimacy strategy available**

Secure major customer

- **Customer acquisition complete**
  - Expected to make additional long-term supply agreement with existing customers
  - Increase in local demand at existing/ new plants in North America under USMCA[1)]

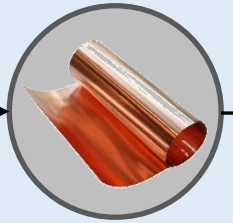
1) USMCA, US-Mexico-Canada Agreement: Effective from July 2020, tariff-free benefit is given only when 75% or more major vehicle materials/parts are acquired locally

Copper Foil Business Overview

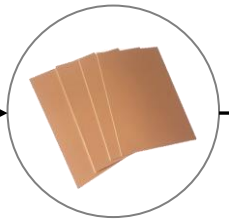
Copper foil is a cathodic electrolytic material used for high-end applications such as AI·Robot·Network and semiconductors

Solus Advanced Materials

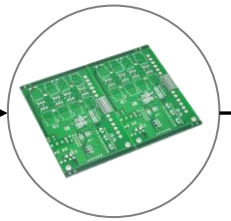
Copper Scrap



Copper Foil



(CCL)[1)]

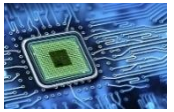


(PCB)[2)]

5G Communications Devices

Data Center

Electronic Devices



Semiconductors

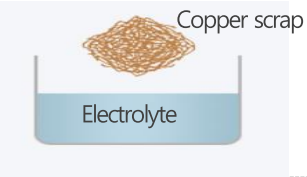
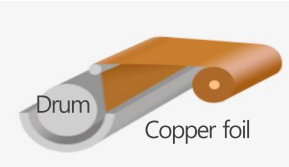
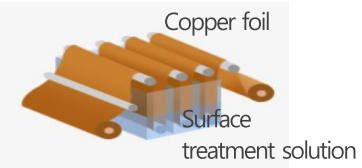
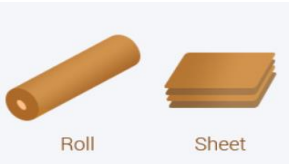
Artificial Intelligence

Robot

1) CCL: Copper Clad Laminate
2) PCB: Printed Circuit Board

Copper Foil Manufacture Process

5 Steps for Completion: Dissolving → Plating → Surface Treatment → Slitting → Inspection & Shipping

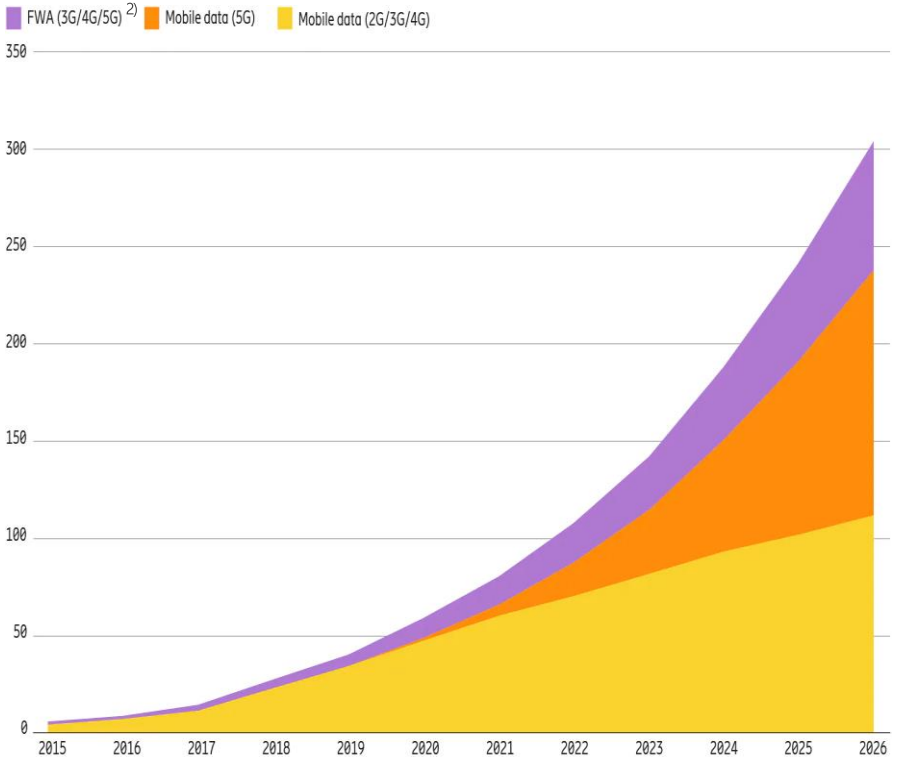
Dissolving		Prepare electrolyte for plating by dissolving the raw material in electrolyte solution
Plating		Produce copper foil by plating Cu ion on drum in electrolyte solution
Surface Treatment (Additional process compared to Battery Foil)		Add copper foil to surface treatment solution to improve copper foil functionality and prevent oxidation
Slitting		Slit in width direction according to customer demand size
Inspection & Shipping		Pack and ship after strict quality inspection

Copper Foil Market Growth

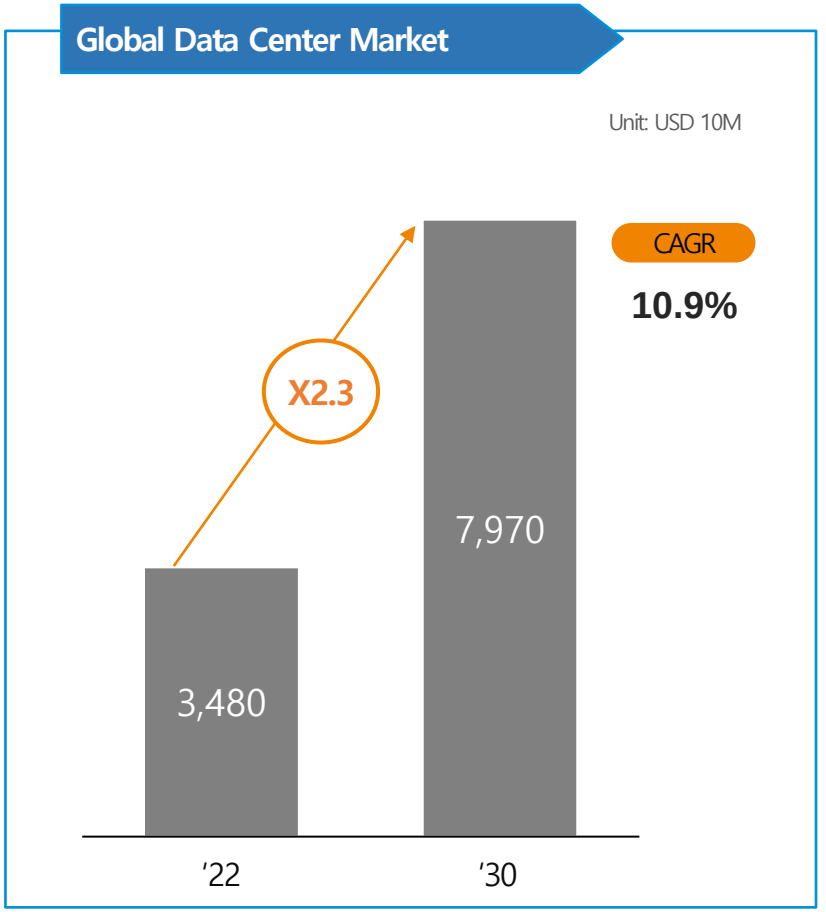
Wireless infrastructure expansion, increased data traffic leading to higher demands for high-end copper foils for data centers

Global Mobile Data Traffic

Unit: Exabyte[1] per month Source: Ericsson Mobility Report, Prismark



Global Data Center Market



*출처:Prescient & Strategic Intelligence

1) 1,000,000 Terabytes = 1,000 Petabytes = 1 Exabyte
2) FWA(Fixed Wireless Access): Wireless communication technology that provides high speed internet service via wireless connection of fixed customer device to base station, the network connection point.

Unique Position in Market

Global No.1 high-end copper foil manufacturer with 60 years of R&D and mass production experience

No.1 in High-end Copper Foil Material

M/S No.1(54%)[1] in high-end copper foil used

- Low Loss Copper foil
- High Frequency Copper foil
- Ultrathin Copper foil for Semiconductor Package

Growth Acceleration Strategy

Increased number of high profit products for cloud services and data centers

Leading the market with the development of ultra thin copper foil (less than 2um) mass production technology for semiconductors

1) '2022

60 years of Knowhow Accumulated

- 1959 Establishment of Circuit Foil Corporation Bordentown Inc. (New Jersey, US)
- 1960 Establishment of CFL (Luxembourg)
- 1970 Establishment of CFL-Furukawa JV
- 2014 Doosan Corp. acquired CFL
- 2021 3,000ton expansion of CFL Copper Foil (Capa. Total 15,000 ton)
- 2022 EU GreenSPEED project participation

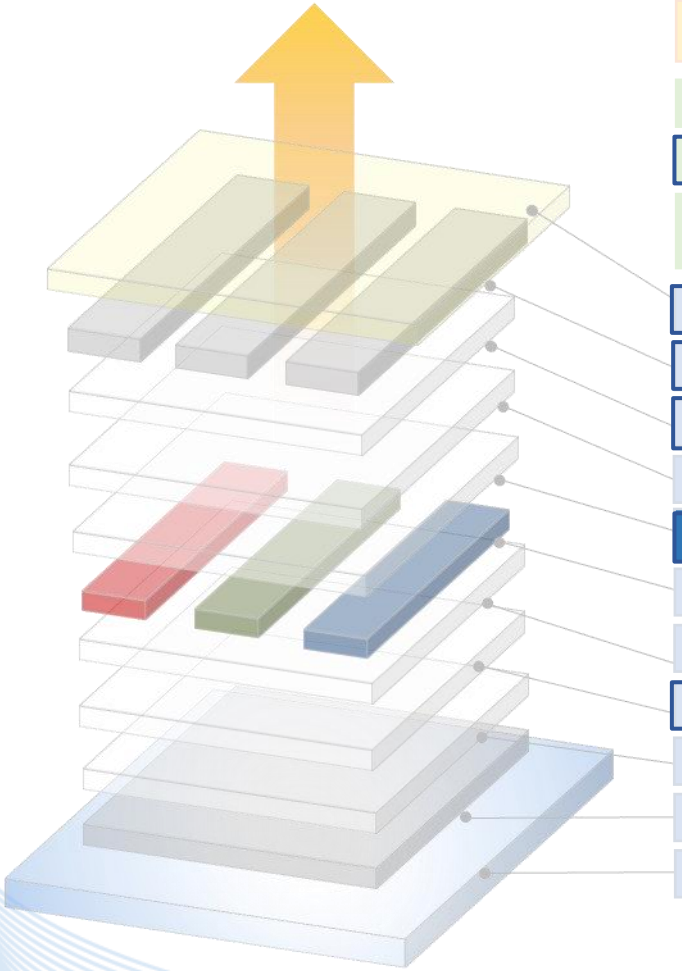
60 years+ experience in R&D and mass production enable us to secure leading technology of copper foil & stable supply of products

- Established in 1959 with 60 years of know-how accumulated
- Developed & mass-produced world's first battery foil
- Secured mass production technology of ultrathin copper foil(less than 2um) for semiconductors
- Investment in expansion for a 30% increase in production capacity, promoting competitiveness

Electro-Materials Business Overview

Manufacture key OLED materials to supply to major global panel makers

Solus Advanced Materials Business Field seen through OLED Layer Structure



QD Ink	QD
Sealant	Encapsulation Film
FILLER	
TEF (Thin Film Encapsulation)	
CPL (Capping Layer)	Vapor Deposition
Cathode	
EIL (Electro Injection Layer)	
ETL (Electron Transport Layer)	
aETL/HBL (Hole Blocking Layer)	
EML (Emitting Layer)	
EBL (Blocking Layer)	
HTL (Hole Transport Layer)	
HIL (Hole Injection Layer)	
ITO	
Glass	

: Current layer supplied by Solus Advanced Materials

Core Development Field: EML

- High efficiency, long-lived green phosphorescence P/N host
- Long lifetime deuterated fluorescence blue host
- High T1 blue phosphorescence host

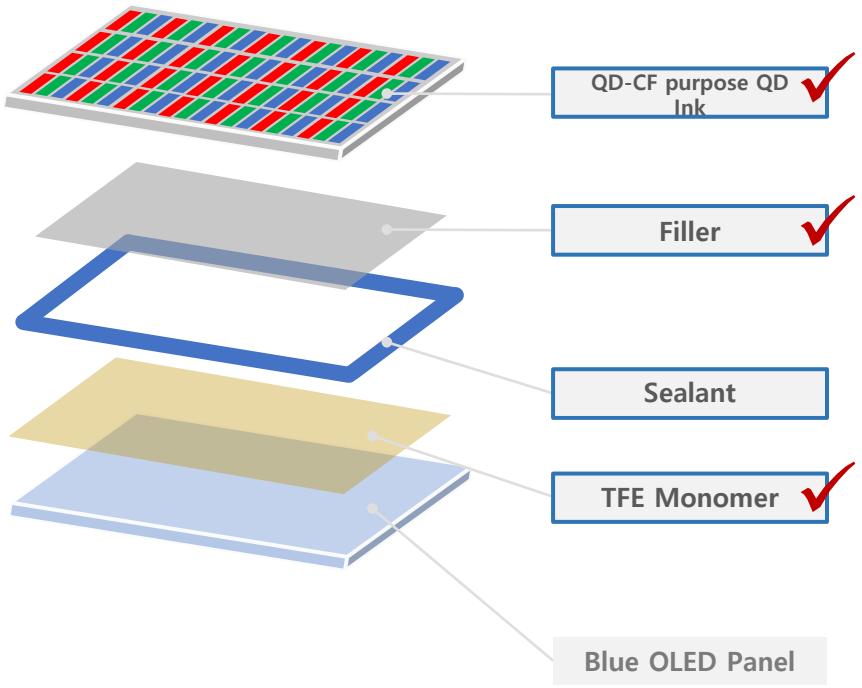
Core Business Field: aETL/HBL (Hole Blocking Layer)

- Core technical element to maximize OLED luminescence efficiency
- 30% increase in blue brightness and vivid color realization
- Increase lifespan of OLED panel

Business Portfolio Expansion

- Enter OLED organic material and encapsulation market for business portfolio expansion
- Develop QD Ink, a core technology for next generation display, to secure future growth engine

Non-light emission material business Field seen through QD-OLED Layer Structure



: At present, Solus Advanced Material's main development materials

Filler (SDC TV)

Direction of key project:

- Superb refraction rate for maximum light emission efficiency
- Original cost reduction to ensure prevention of entry of competing vendors in the market
- Promotion for expanded application to other items

QD Ink (SDC TV)

Direction of key development:

- Top level optical conversion efficiency and low viscosity ink manufacturing technologies
- High heat resistivity quantum dot thin layer manufacturing technology
- 30nm or less FWHM implementation and process stability improvement
- 25cps or less low viscosity QD ink manufacturing technology

Low dielectric TFE (Mobile)

Direction of key development:

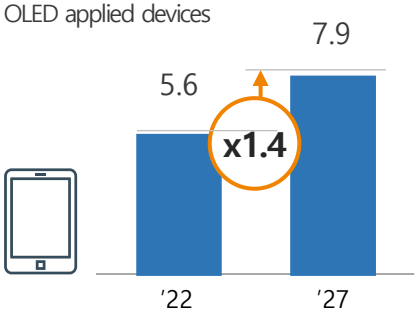
- Low dielectric characteristics assigned to improve the touch sensitivity.
- Provide highly functional materials responding to changes in panel structures
- Control the varying properties specific to the inkjet process of client
- Phone market entry followed by gradual expansion of application for IT

Future Growth Business Portfolio

OLED material demand expected to grow 1.3 times in 2027 with increasing adoption of OLED display

Mobile

Unit: 100M
OLED applied devices

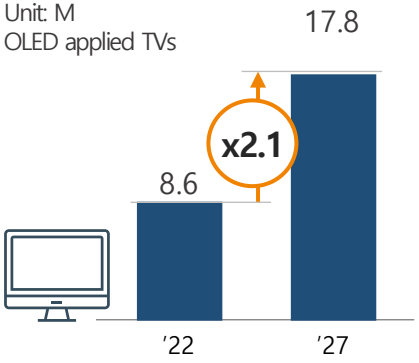


Major smartphone manufacturers

Prospect for increase in OLED display adoption

TV

Unit: M
OLED applied TVs



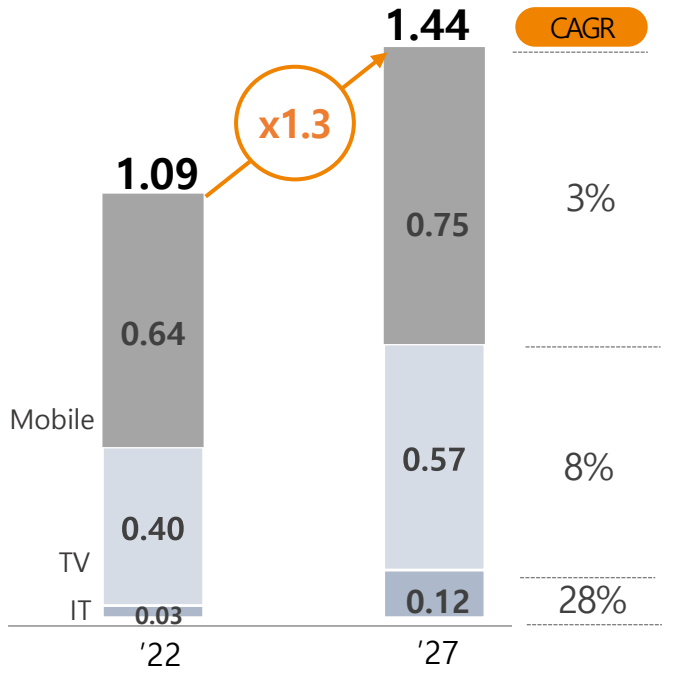
Major TV manufacturers

Prospect for increase in OLED TV mass production

Source: IDC, Omdia

OLED materials market forecast

Unit: USD 1B



Unique Position in the Market

Holding core IP for functional material & major panel maker references

Holding Core IP

Holding core IP for OLED blue functional material (aETL) [1)]

- Enhance electric power efficiency of blue by 30%, which has high power consumption, and improve brightness
- Core IP: Application(December 2013), Registration(July 2016)

aETL was awarded the Minister prize by Ministry of Trade, Industry and Energy at the Korea Technology Awards in 2015

No.1 market share in aETL products within global organic material market

Major panel maker references

Holding product supply record to global TOP panel makers and joint products being developed

- Continuous supply of OLED materials for mobiles
- Enter mass production of OLED TV organic material & encapsulation

- Continuous supply of partial OLED materials for mobiles since 2017
- Joint development of high-end materials for mobiles

Growth-Acceleration Strategy

Increase product supply for OLED TV ➢ Increase product supply of existing luminous materials and non-luminous materials

Increase product supply for IT ➢ Market growth and product supply increase with increase in OLED adoption in laptop and tablet markets

Increase new material supply for LGD ➢ Expand product range supply for TV/Mobile

Joint product development with global panel maker (in China Region) and increase supply through customer-focused support

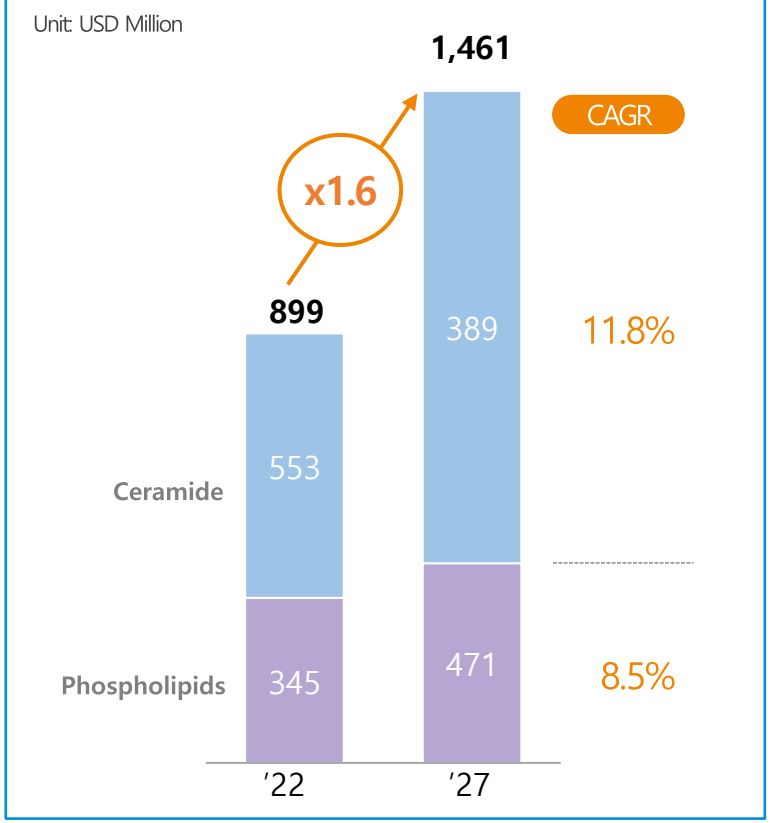
1) KR 2013-0157627

Bio market expected to grow 1.6 times with increasing customer needs for natural ingredients

Cosmeceutical Nature derived moisturizer (Ceramide)[1)]	With the advancement of functional derma cosmetics containing ceramide, prospects for growth in technology development and applied field
Pharmaceutical Phospholipids (PL)[2)]	Prospects for continuous growth as essential ingredient in lipid emulsion infusion market for the aging society and patients with nutritional imbalance
Pharmaceutical/ Cosmeceutical Natural emulsifier (PC)[3)]	As the trend of preference for nature derived materials, prospects for high growth in PC markets, which is effective in improving liver function (fat decomposition)
Nutraceutical Natural ingredients for cognitive function enhancement (PS)[4)]	With an aging population trend, prospects for high growth in PS market, which is effective in enhancing cognitive function

1) Ceramide: Bio-material used in cosmeceuticals for skin moisture and anti-inflammation
2) Phospholipids: Complex fluid that plays an important role in forming the cell membrane
3) Phosphatidylcholine: Typical phospholipid (rich in the brain/neurotransmitter/egg yolk lecithin)
4) Phosphatidylserine: A kind of phospholipid (rich in the brain/neurotransmitter/soybeans)

Biomaterial market and target market forecasts



Source Ceramides Market: Global Industry Analysis and Forecast 2019 Persistence Market Research; Phytosphingosine Market: Global Opportunity Analysis and Industry Forecast 2016-2023 Allied Market Research 외

솔루스 첨단소재
Solus Advanced Materials

Thank You