

2017 Tech. Seminar

2017. 07. 20





Contents_ Investor Relations 2017

I. Semiconductor Materials Business

II. Wireless Charging Business

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Market Insight- 기술을 장의적으로 결합하는
Global Specialty MARKETER

Session 1. Semiconductor Materials Business



Session 1. Semiconductor Materials Business

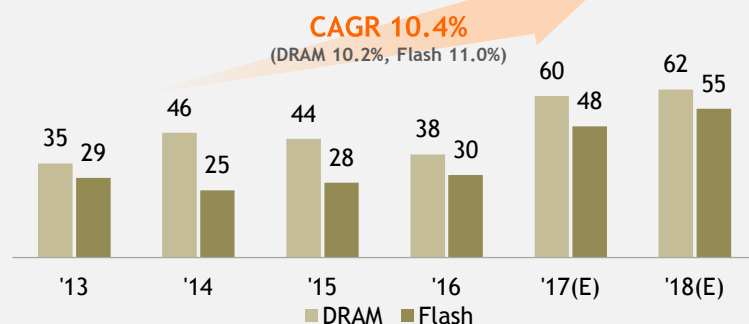
1. SKC Semiconductor Materials Business
2. CMP Pad
3. CMP Slurry
4. China Wet Chemical Business

1. Semiconductor Industry Market Outlook

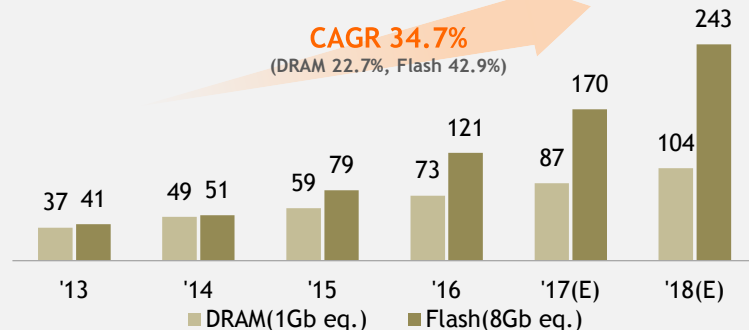
Semiconductor materials business represent a significant growth opportunity for SKC, on demand growth driven by stable global memory semiconductor market growth and capacity expansion

Global Memory Semiconductor Market

Revenue Basis (Unit : bn USD)



Quantity Basis (Unit : bn pcs)



Key Factors

Market

Continued Global Market Growth

- DRAM/NAND demand growth driven by expanding memory application

China Semiconductor Investment Expansion

- Government led investment policy
- Memory/System semicon. investment acceleration

Client

Continued DRAM/NAND Tech Transition

- Demand growth for high density/low power semiconductor
- Rapid equipment demand growth driven by NAND capacity expansion

Technology/Quality First Sourcing Policy

- Strong emphasis on technology and quality control
- Sourcing mainly from established Top-tier suppliers

Competitor

Strong Technology and Price Competition

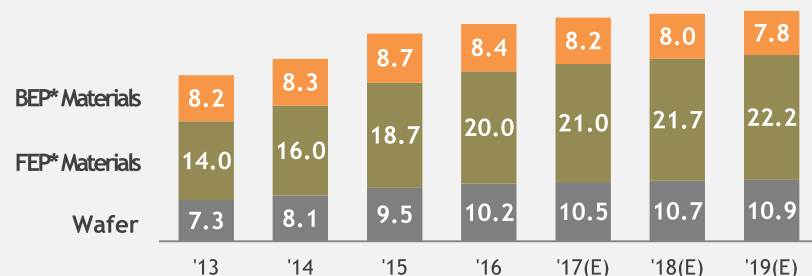
- Technology/cost leadership acting as entry barrier
- Expanding tech. leadership with continued CAPEX

2. Semiconductor Materials Industry Outlook

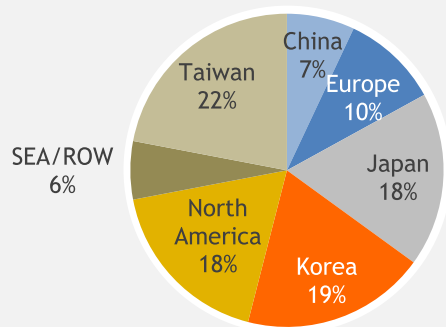
- 2016 global semiconductor materials market size 39tn Won. Expected to grow 3% per annum
- NAND demand leading overall industry growth, offering strong growth prospect for semicon. materials

Global Semicon. Materials Market :

37tn Won ('15) → Expected to grow 3% per annum



70% of Global Demand Located in Asia (Korea, Japan, Taiwan, China)



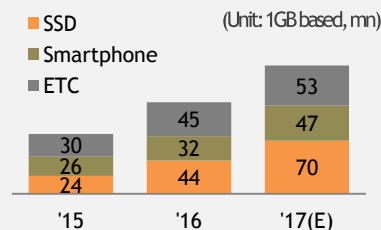
Demand by Geography

- Taiwan represents highest demand at 22%
- Korea, 19% of global demand
- China semicon. materials market to grow 10% per annum (China semicon. CAPEX : +150 tril. Won)

Semicon. Market Growth Led by NAND Demand

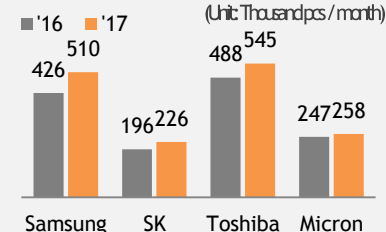
'15~'17 NAND Demand

2X ↑ in 2 years



'15~'17 Capacity

Samsung/SK/Toshiba CAGR 8%



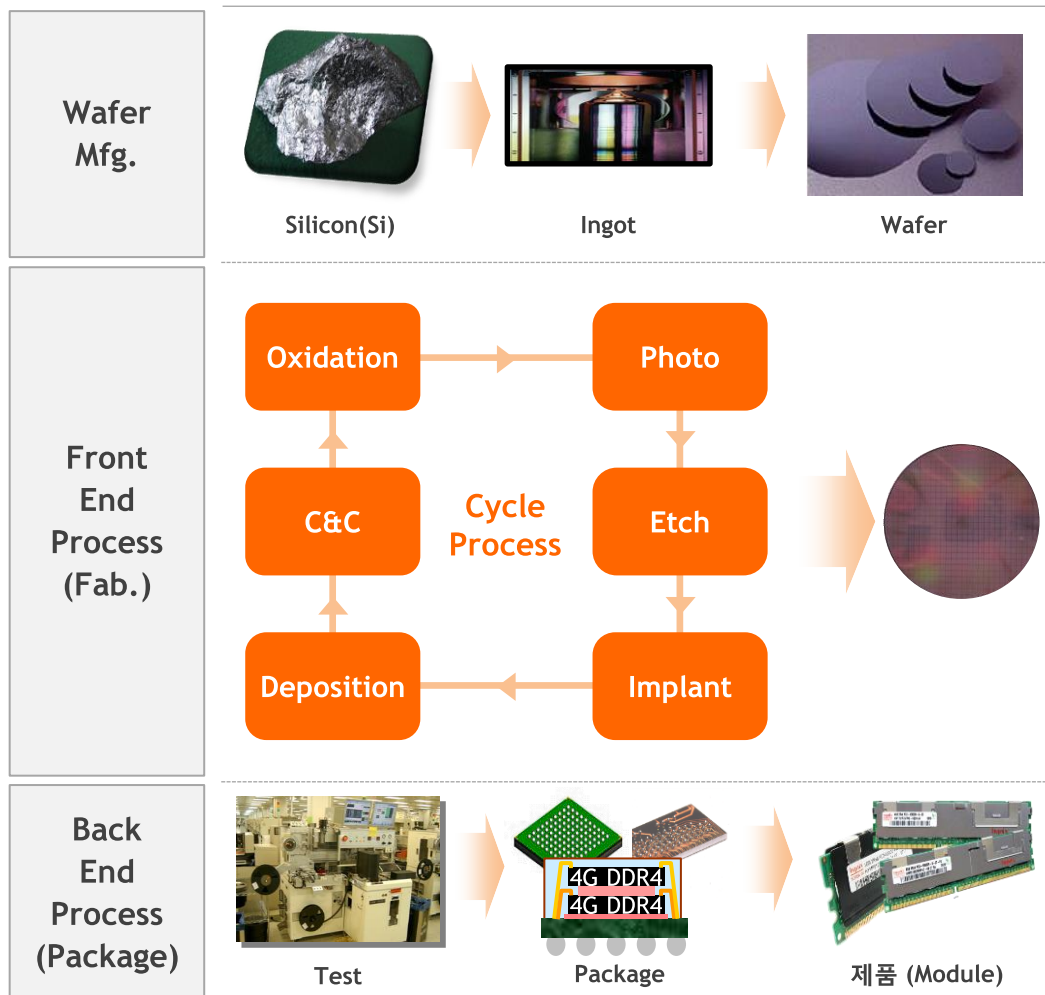
New Tech. for Nano fabrication Process and 3D NAND Likely to Increase Semicon. Materials Demand

Type	Technology	Key Materials
Flash	3D NAND	CMP, Wet Chemical, Precursor, PR
DRAM	TSV	CMP, Precursor, Electroplating chemical
Logic	QPT	Precursor, Wet Chemical, PR
	FinFET	CMP, Wet Chemical

→ Solid outlook for CMP material and Wet Chemical

app. Key Materials/Components during Semicon. Mfg. Process

Semicon. Manufacturing Process Overview



Key Materials/Components

Process	Key Materials/Components
Wafer Manufacturing	Si Wafer Slurry (for Wafer) abrasives, Blade, oil
Oxidation	- Materials : SiO ₂ , SiN, etc. Gas Chemical
Photo	- Materials : Photoresist, Interlayer materials, AR film, Develop sol.
Etch	- Components : Chuck - Materials : Bulk Gas (NF ₃ , C ₂ F ₆) Wet Etch (HSN, HF)
Deposition	- Materials : Precursor, Target
C&C	- Materials : Slurry, Stripper - Components : PAD, Conditioner
Back End Process	- Materials : Substrate, PCB, Adhesives - Components : Probe-card, tester BIB Socket, M/B

3. SKC Semiconductor Material Business Domain

- Various semiconductor front end process materials exist and typically dominated by handful of companies
- SKC will focus on CMP process materials, wet chemical, and ceramic parts
(Considering semicon. technical trend, in-house technical competency, and market entry potential)

Front End Process Materials Market Overview

Materials	Size (tn Won) Global	Items	Key Suppliers
Si Wafers	9.1	Si Wafer	Shinetsu, Sumco, GlobalWafers, Siltronic, SK Siltron
Photo Mask	3.8	Photo Mask, Blank Mask	Toppan, Photronic, DNP, Hoya, S&S Tech, Shinetsu
Photo Chem.	3.6	PR, SOC, SOD, Process Chem.	Led by 7 major companies including JSR, Dow, Fuji
2 Wet Chemicals	1.3	Etchants, Cleaner	Specialist companies lead respective items
Gases	4.1	Process Specialty Chem.	Led by global industrial gas companies
Sputtering Targets	0.8	Al, Ti, Cu, Ta, etc.	Dominated by global 4 majors (Toso, 90% M/S)
1 CMP Pad & Slurries	1.8	CMP Process Materials	Pad(Dow 80% M/S) Slurry(Cabot 40%)
Other/New Materials	3.6	dielectric, Cu-solvent, Precursor	Specialist companies lead respective items
3 Ceramic Parts	2.5	Si, SiC, Al Quartz	Global Equipment Maker → OEM

※ Source : IHS, NH I&S Reserach

SKC Semicon. Materials Business Domain

Business Domain Selection Standard

- Considered **semicon. demand & tech. trend, potential to acquire technology and correlation with existing business**
- Identified **CMP process materials and wet chemicals** given semicon. nano fabrication trends and expansion of 3D NAND
- Excluded items that offer low potential for market penetration due to technical entry barrier → Photoresist, Si Wafer excluded

Why CMP materials, Wet Chemical, & Ceramic Parts

- CMP Pad & Slurry**
 - Expect demand growth on positive semicon. tech. trend
 - Potential to utilize in-house technical competency
- Pad : PU / Slurry : Ceramic powder processing
- Wet Chemical**
 - Increased needs of high-value cleaner for nano fabrication
 - Potential to utilize operational expertise from existing chemical biz. and co-work with specialty companies
- Ceramic Parts**
 - Business domain of SKC Solmics
 - Expand high-value items utilizing ceramic processing technology

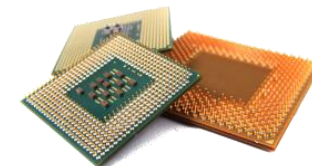
4. SKC Semiconductor Materials Business Vision

Market Insight과 기술을 바탕으로
Global Specialty **MARKETER**

- 1 Pursue qualitative growth driven by technology based differentiated specialty materials
 - CMP material line up expansion and next generation product specialization
 - Wet chemical product internalization
- 2 Expand global presence, entering emerging markets (China), through strengthening partnership/alliance with customers
 - Expand CMP material business in China / Taiwan market
 - Operated a wet chemical manufacturing site in China



**Semiconductor
Materials / Components
Global Specialty Company**



Session 1. Semiconductor Materials Business

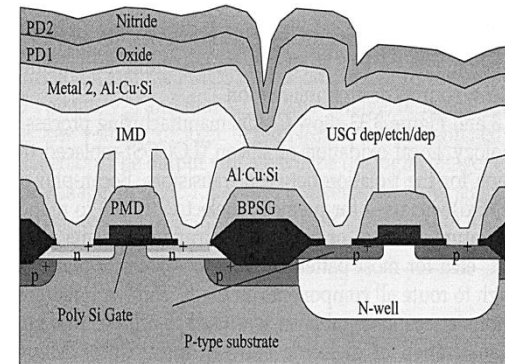
1. SKC Semiconductor Materials Business
2. **CMP Pad**
3. CMP Slurry
4. China Wet Chemical Business

1. CMP (Chemical Mechanical Planarization) Pad Product Overview

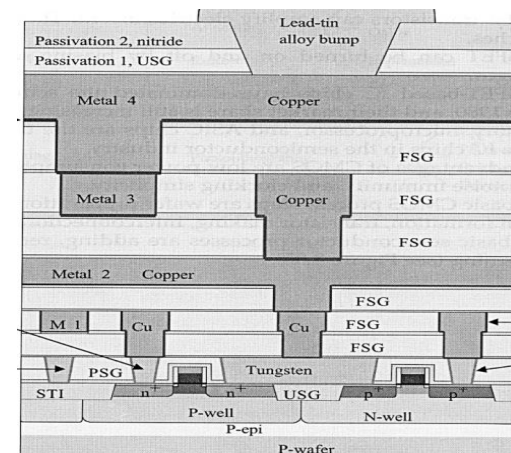
What is CMP?



Without CMP

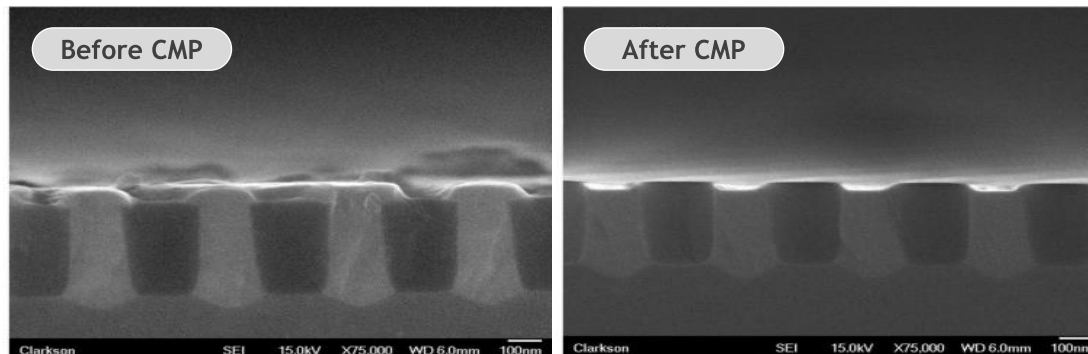
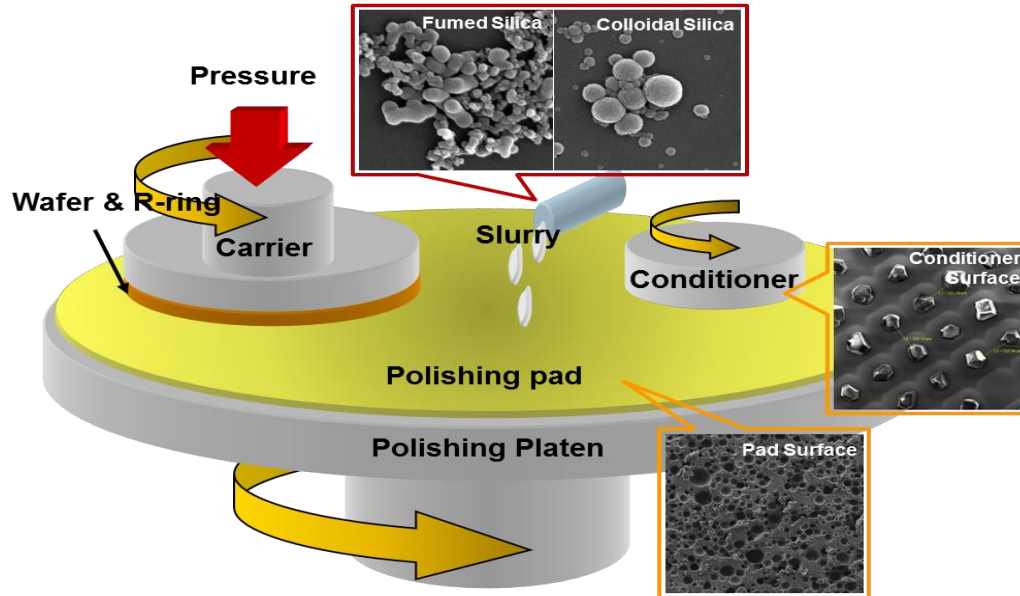


With CMP

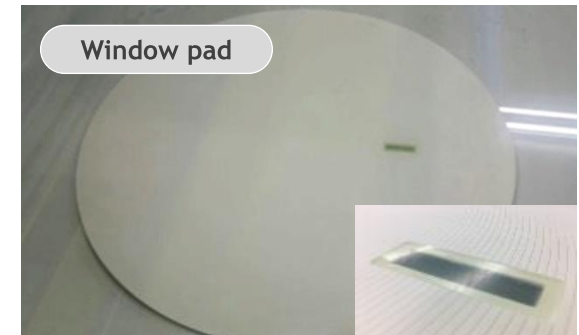


1. CMP (Chemical Mechanical Planarization) Pad Product Overview

CMP Component



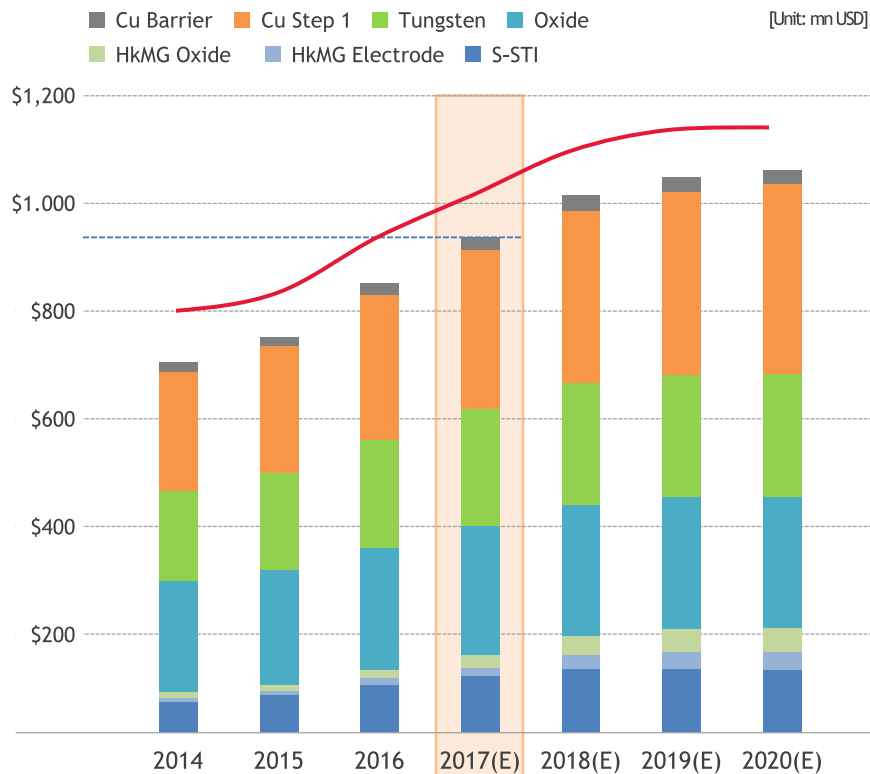
CMP Pad



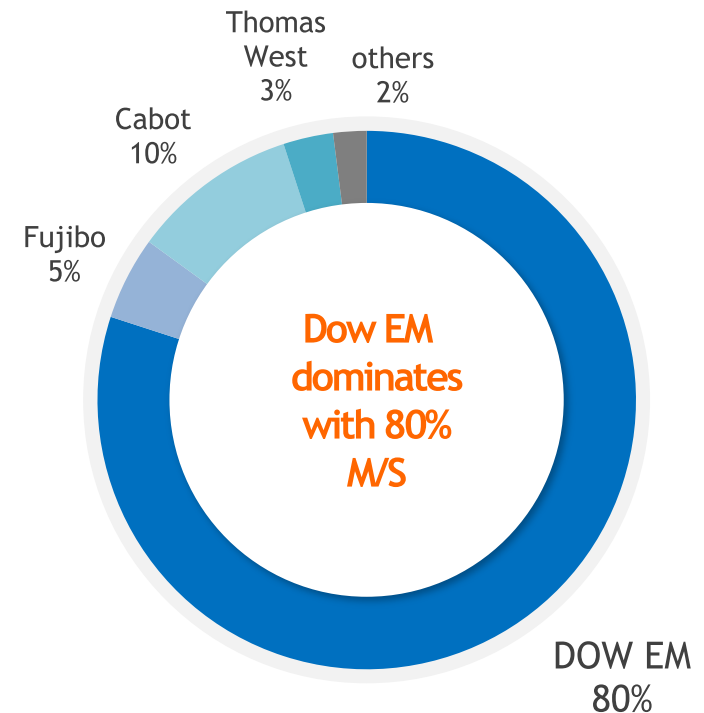
2. CMP Pad Market Overview

- Global CMP market expected to grow to 1bn USD by 2019. Domestic market led by Oxide CMP pad, while global market is led by Cu CMP pad
- Dow EM dominated the market with over 80% M/S. Cabot(NexP) in 2nd place with 10% M/S

Global CMP Pad Market Outlook



CMP Pad Competitive Landscape (2016)



3. SKC CMP Pad Business Strategy

- Commercialization of hard pad (W, ILD) targeting SK hynix
- Expand product portfolio to semi-hard pad and expand customer base to China/Taiwan producers/Samsung using SK hynix supply reference

Market Entry Strategy

(Unit : bn Won)	W	Oxide		Cu Bulk	Sum
		ILD	STI		
SKH	① Priority	② Semi-hard			
Taiwan	② Expand Customer Base				
China					
Samsung					
US/Japan					
Sum	150	210	140	210	710

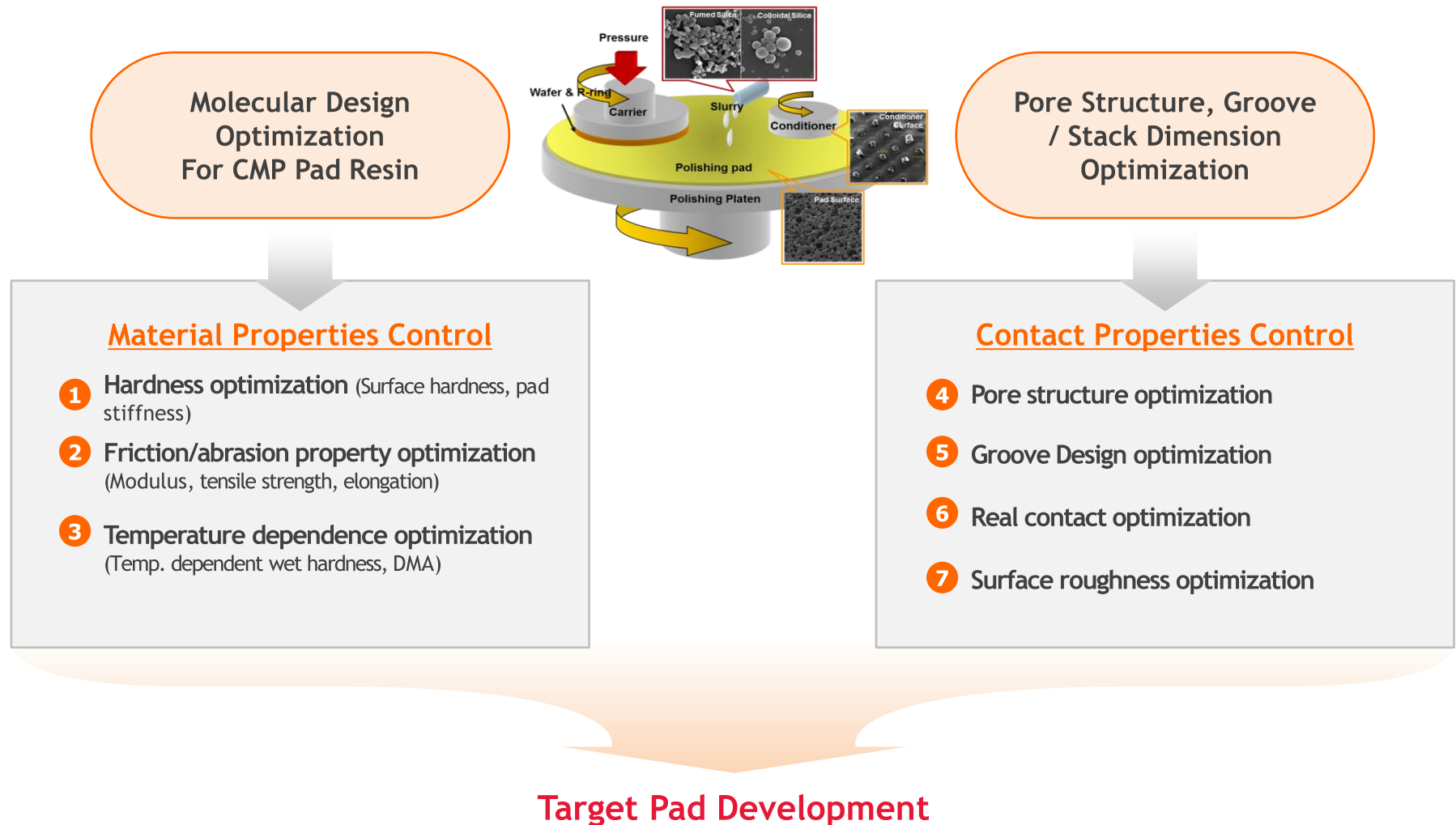



Successfully commercializing CMP pad biz. starting with hard Pad

Market Entry Specific Plan

	① 1 Stage	② 2 Stage
Hard Pad (W, ILD)	<u>'16 W Pad Commercialization</u> '16.11 SK hynix qualification <u>'17 ILD Pad Commercialization</u> - Target SK hynix qual. during 2017 - Start China/TW qual. process ('18.1Q~)	<u>Increase Domestic M/S</u> - Expand SK hynix M/S - Start Samsung qual. process <u>Expand to China/TW</u>
Semi-hard Pad (STI, Cu)	<u>Secure Generic Technology</u> <u>Start Initial R&D (Dec. 2017) and Build Data Base</u>	<u>Obtain SK hynix Qual. and Expand Customer Base</u>

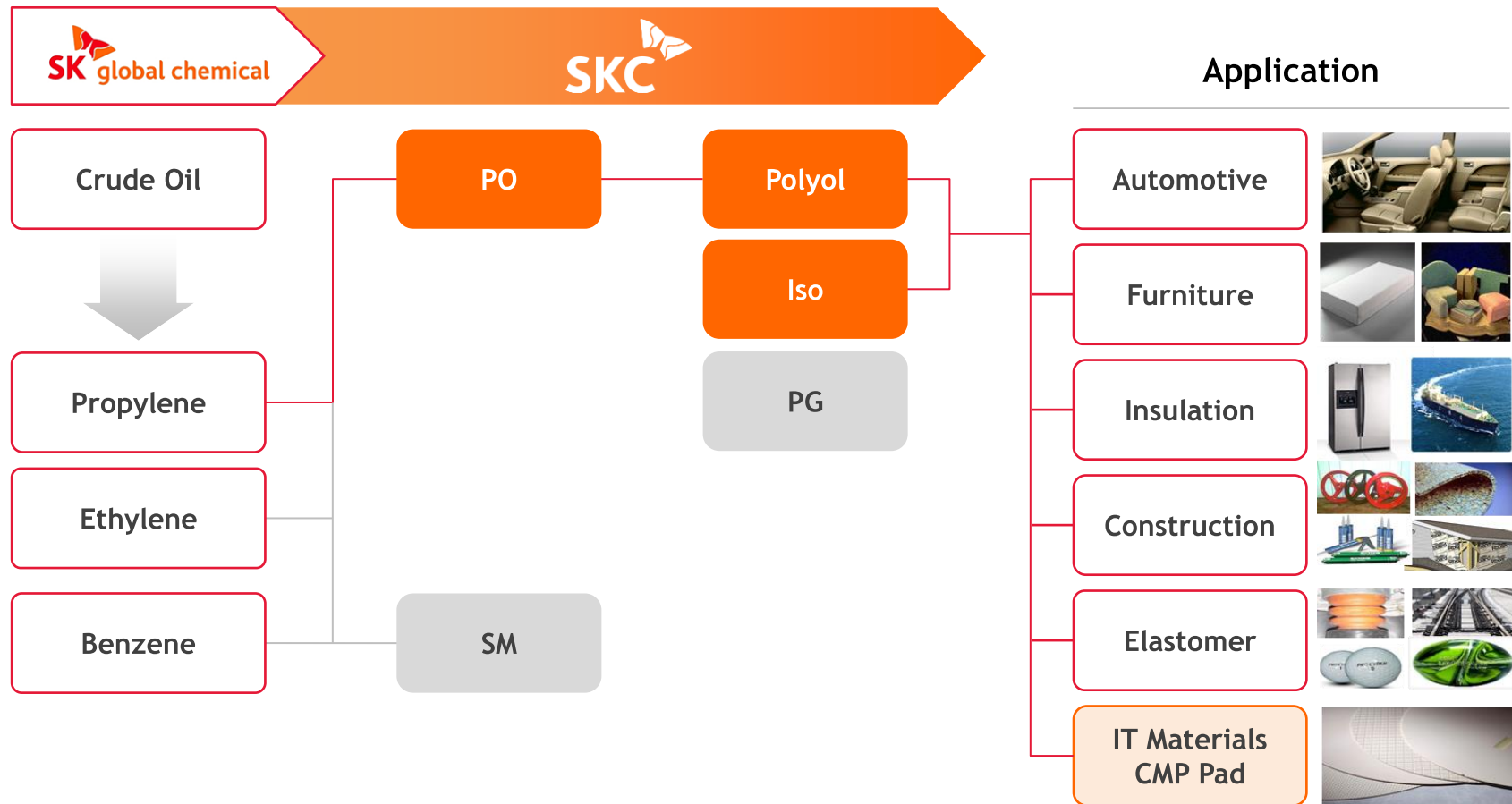
4. SKC CMP Pad Development Status



4. SKC CMP Pad Development Status

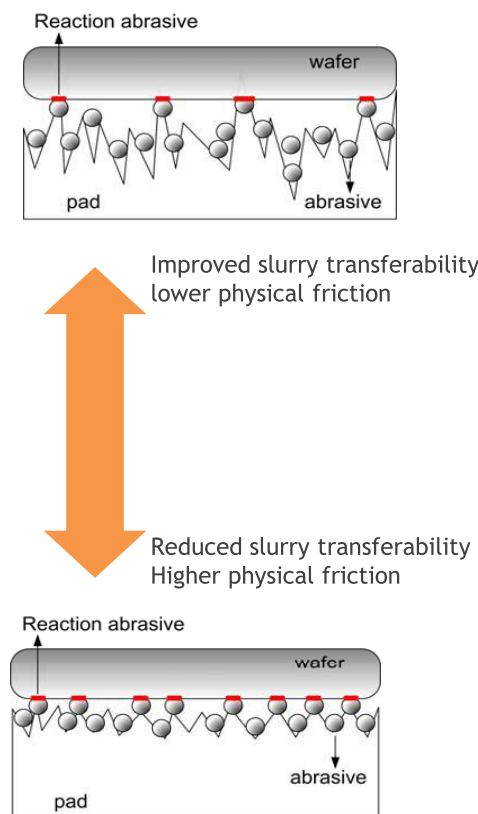
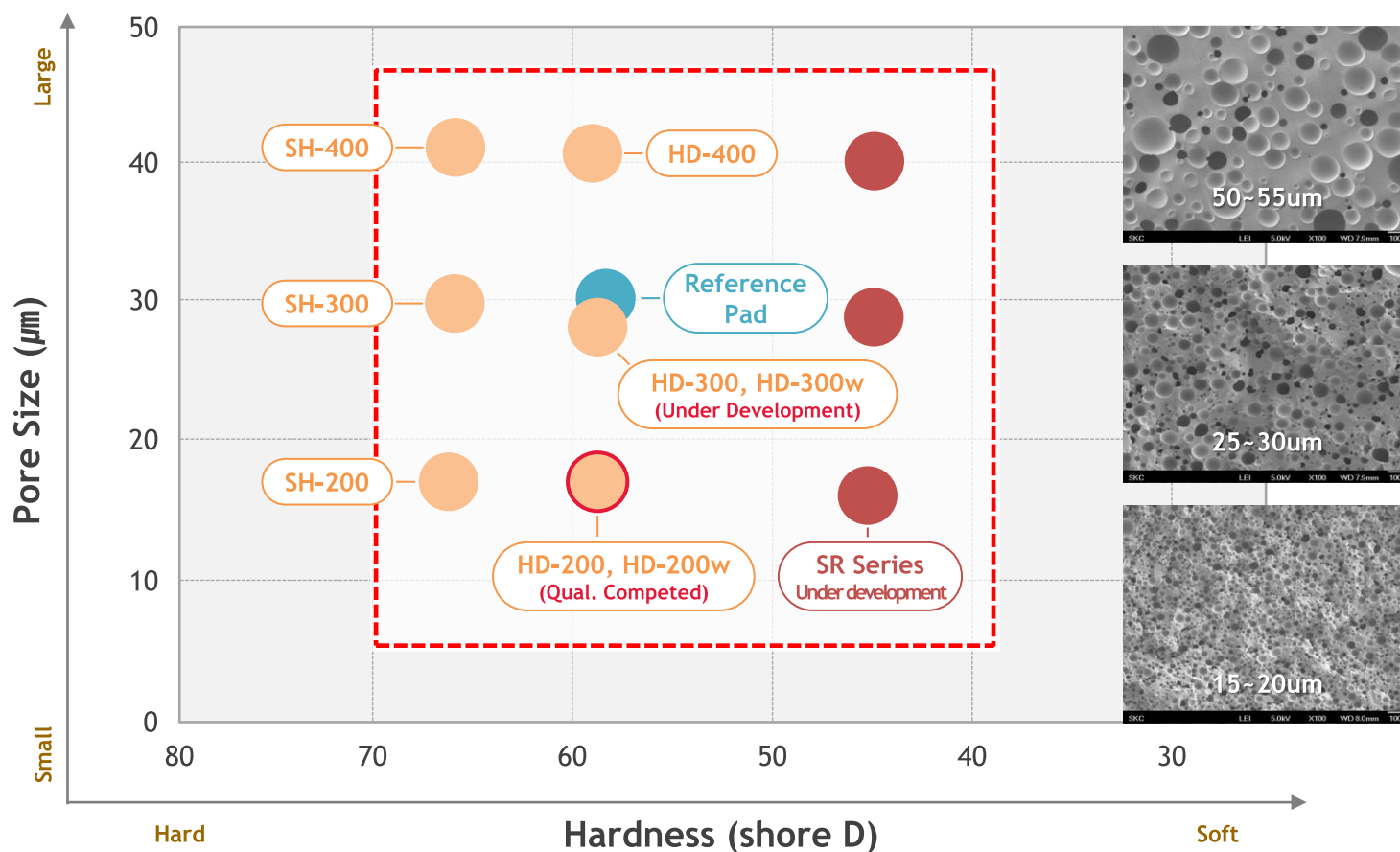
- PU (Polyurethane)

a thermoplastic polymer containing the group NHCOO : used for padding and insulation in furniture, clothing, and packaging, and in the manufacture of resins for adhesives, elastomers, and fillers



5. SKC CMP Pad Qualification Status

- 6 product line up based on hardness/pore size (3 HD Series products, 3 SH Series products)
- Able to offer customize product based on customer needs (hardness 40~70D, pore size 15~50um)
- Window, Non-Window, Groove, Hot-melt Lamination, NWF/suede type Sub



6. R&D Facility

CMP Materials (Pad, Slurry) R&D facility

Location

SKC R&D Center
(Suwon, South Korea)

Equipment

**CMP Polisher and
Analysis tools**

CMP Lab



6. R&D Facility



Sheet R&D Pilot



Slurry R&D Lab



Pad Component
Analysis Equipment



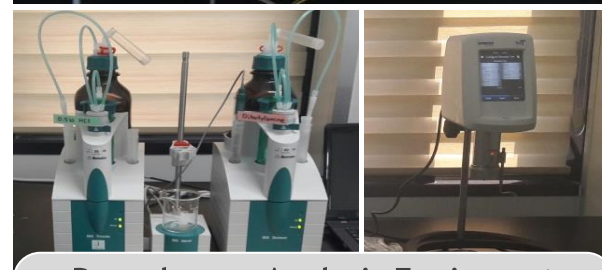
Pad Thermal Behavior
Analysis Equipment



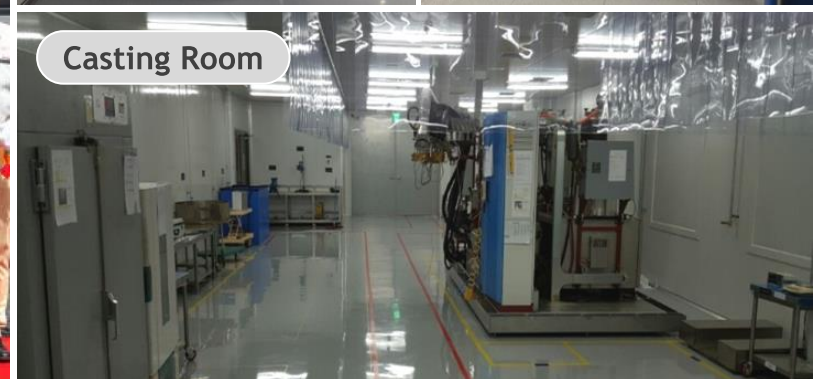
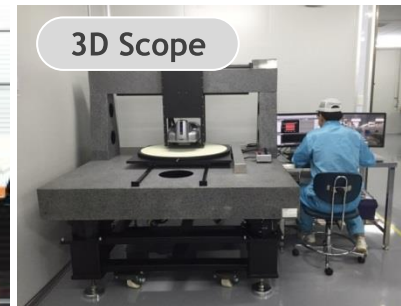
Pad Property
Analysis Equipment



Prepolymer Analysis Equipment



7. Manufacturing Facility



Session 1. Semiconductor Materials Business

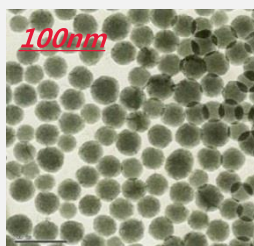
1. SKC Semiconductor Materials Business
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1. CMP Slurry Product Overview

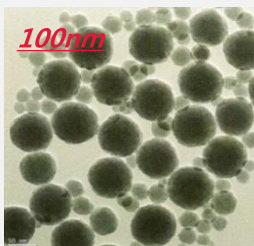
CMP Slurry Overview

CMP Slurry : surface abrasive containing inorganic particles

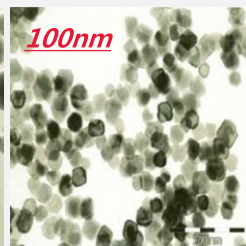
- Solution contains micro ceramic particles



Colloidal Silica(SiO₂)
(Alkoxide glass base)



Colloidal Silica(SiO₂)
(Water glass base)



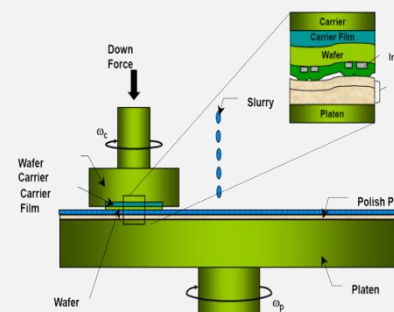
Ceria(CeO₂)
(Calcined)

CMP Slurry Components

Component	Applied Materials	Characteristics
H ₂ O	High purity	90% of total weight
Abrasive	SiO ₂ , CeO ₂ , etc	Nano size micro powder
Corrosion Inhibitor	Ionic polymer	Standard commercial product
Dispersant	Organic/polymer	Assist in oxide film formation
Abrasion Improver	Functional chemicals	Improve abrasion rate, selective abrasion

CMP Process Overview

CMP Process



- Key process for wafer surface planarization
- Disperse slurry during CPM pad polishing to achieve surface planarization

Introduction of New Semicon. Mfg. Process (3D, TSV, etc.)

	Process (Overview)	Impact to CMP Process
3D NAND	Selection gate Control gate Selection gate Memory array	-Vertical layering process -11→19 CMP step increase
TSV		-PKG Wire Bonding replacement -15→17 CMP step increase
LOGIC	Metal Cu Layer	-Device nano fabrication -12→15 CMP step increase

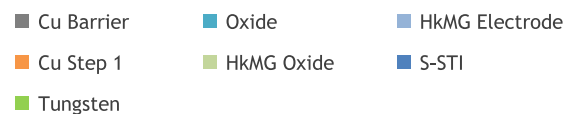
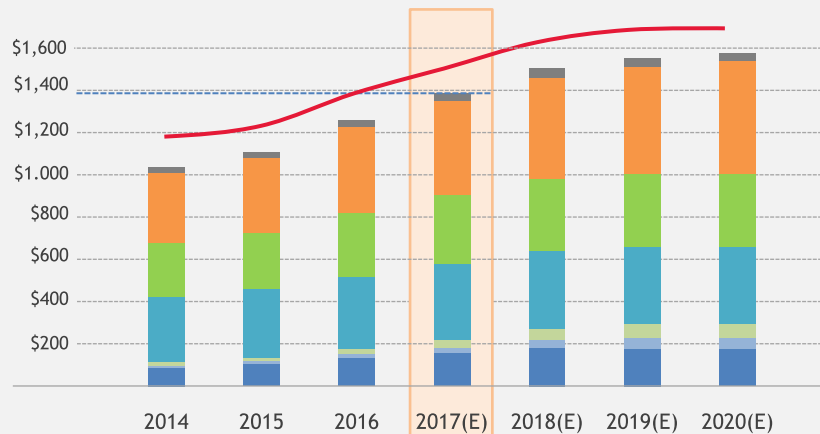
2. CMP Slurry Market Overview

Global Market Overview

Global Market Outlook

- Market size to increase to 1.6bn USD by 2020 (1.4bn USD in 2017)
- Nano fabrication and layering technology leading to higher demand for specialized slurry

(Unit : mn USD)

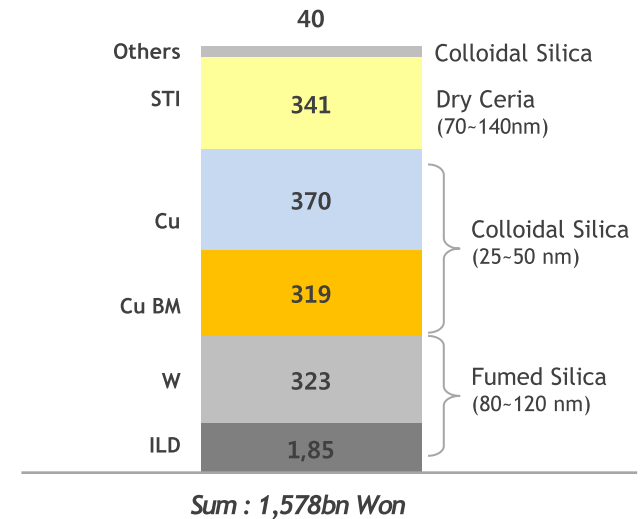


Market Size by Slurry Type

Slurry Product Mix Shift due to Nano Fabrication

- Demand shifting from fumed silica to colloidal silica or wet ceria

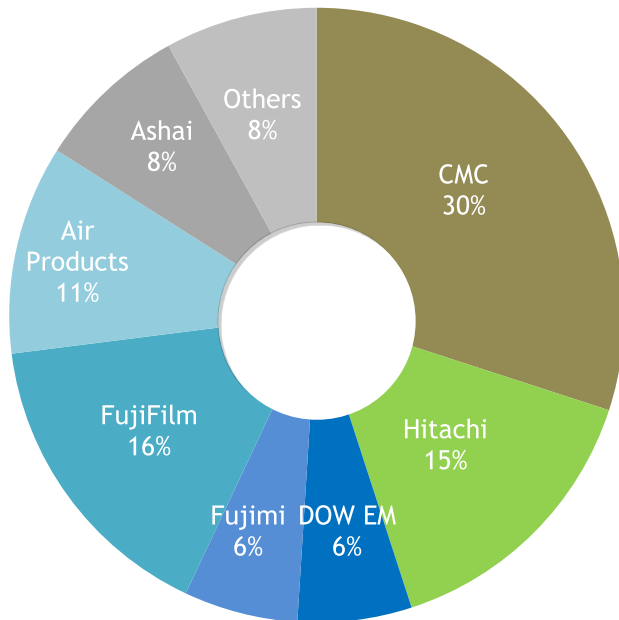
(Unit : bn Won)



2. CMP Slurry Market Overview

Competitor M/S

Global Slurry Supplier M/S (2016)



※ Source: TECHCET's Critical Materials Report

Competitor Status

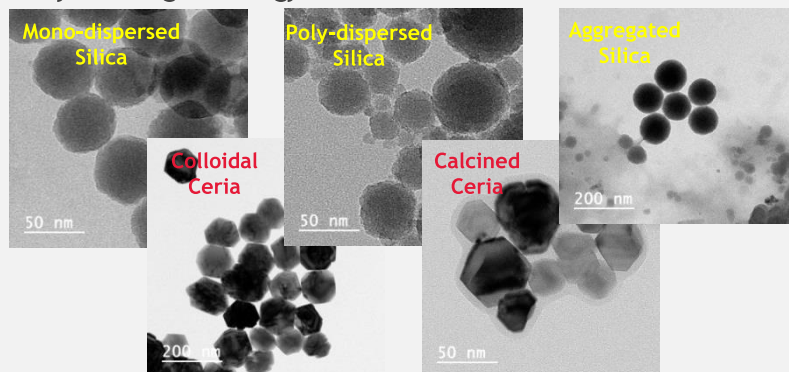
Status of Key Competitors

Company	Status
Company C (US)	- Global M/S #1. Holds patent on W slurry. Recently experiencing M/S reduction (2014 39% → 2016 30%) - Acquired NexPlanar and expanded CMP pad biz. (2015)
Company H (JP)	- Holds patent on Ceria product. M/S #1 for WW Ceria
Company K (KOR)	- Increasing domestic M/S through product localization - Domestic M/S #1 for Ceria, W slurry
Company S (KOR)	- Supply Oxide, W slurry domestically. Developed particle synthesizing technology in-house
Company S (KOR)	- Growth driven by favorable relationship with SEC

3. SKC CMP Slurry Development Status

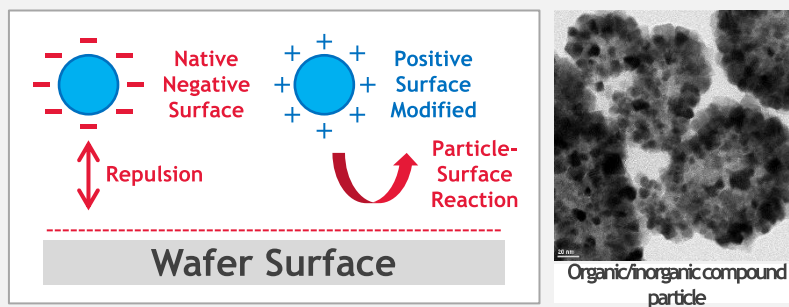
Particle formation Control Technology

- Developing next generation abrasion particle through nano particle synthesizing technology



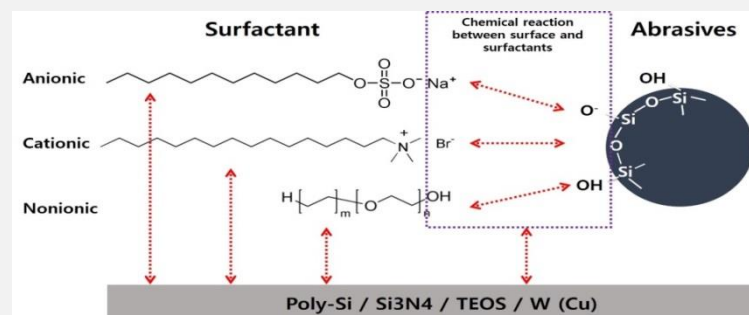
Surface Reforming Technology

- Developing surface reforming compound particle through organic/inorganic compound



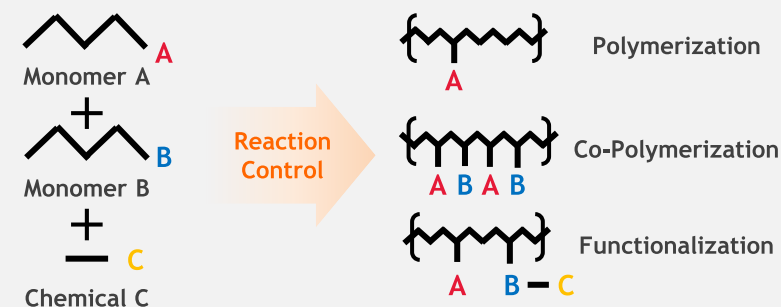
Compound Polymer Additive Composition Control

- Improve abrasion rate and selectivity control
- Improve particle dispensability

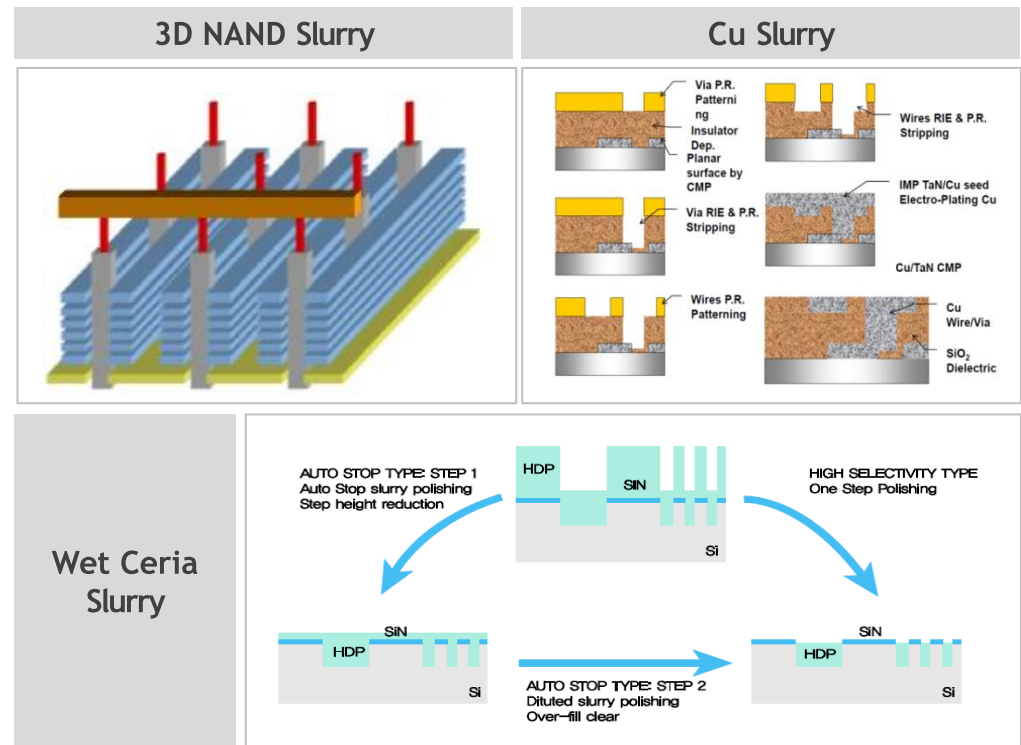
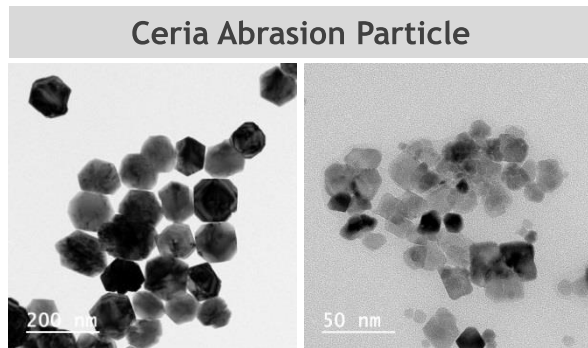
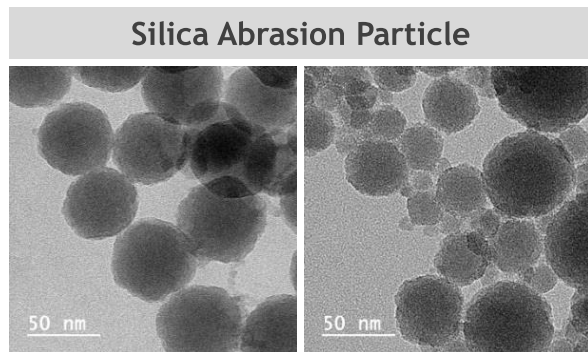
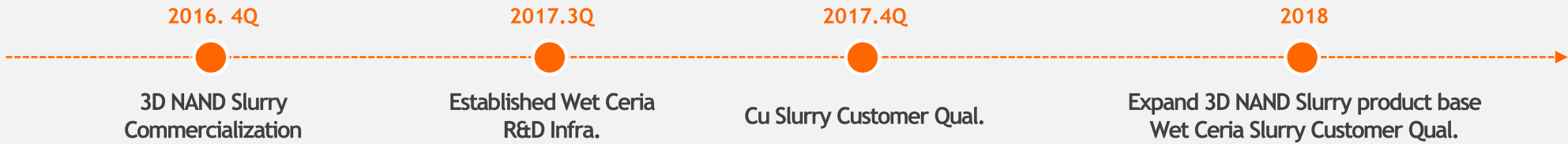


Design Polymer Additive Functionalization Control

- Design and compound polymer functionalization



4. SKC CMP Slurry Business Milestones



Session 1. Semiconductor Materials Business

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4. China Wet Chemical Business

1. Wet Chemical Product Overview

Wafer Mfg.		Si Wafer Slurry (for Wafer mfg.) Felt, Blade, Oils
Front End Process	Oxidation	Materials : SiO ₂ , SiN
	Photo	Materials : PR, SOD, SOC, etc
	Wet Chem.	Materials : Thinner, Stripper, Etchant, Cleaner, etc
	Dry Etch	Materials : Bulk Gas
	Deposition	Materials : Precursor, Target
	CMP 소재	Materials : CMP Pad & Slurry
Back End Process (Package)		Materials : Substrate, PCB, Adhesives

Wet Chemical Market Overview

What is Wet Chemical?

- Chemicals such as etchant, strippers, that are used for cleaning during semiconductor mfg. process

2016 Global Market Size 1.3tn Won

Expanding Global Exposure focusing on China

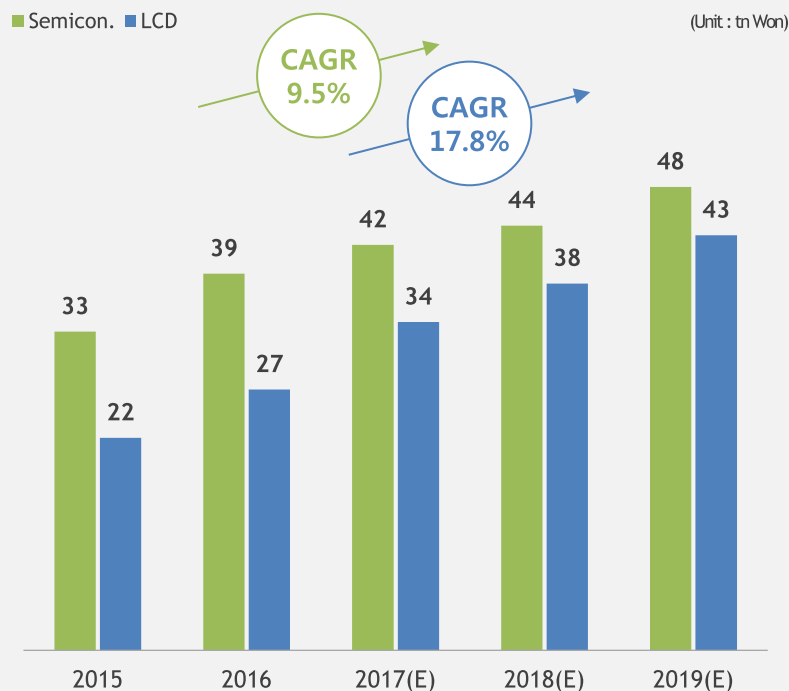
- SK hynix expected to expand in Wuxi (2019)
- New investment expected by Tsinghua Unigroup
 - 3D NAND facility in Nanjing

2. China Semiconductor/LCD Market Overview

China Semicon./LCD Market Outlook

China Aggressively Promoting Semicon./LCD Industry (Made in China 2025)

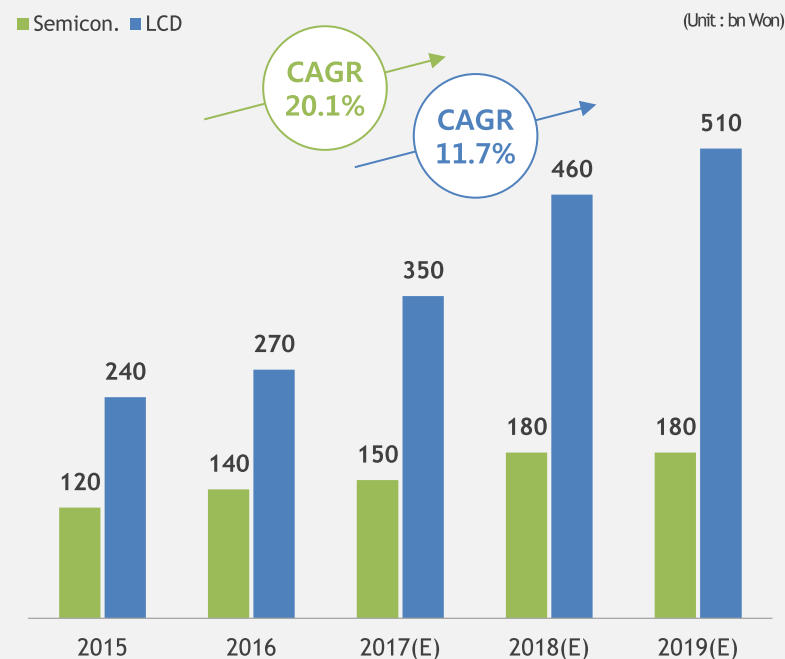
- Increasing investment for manufacturing to localize supply chain



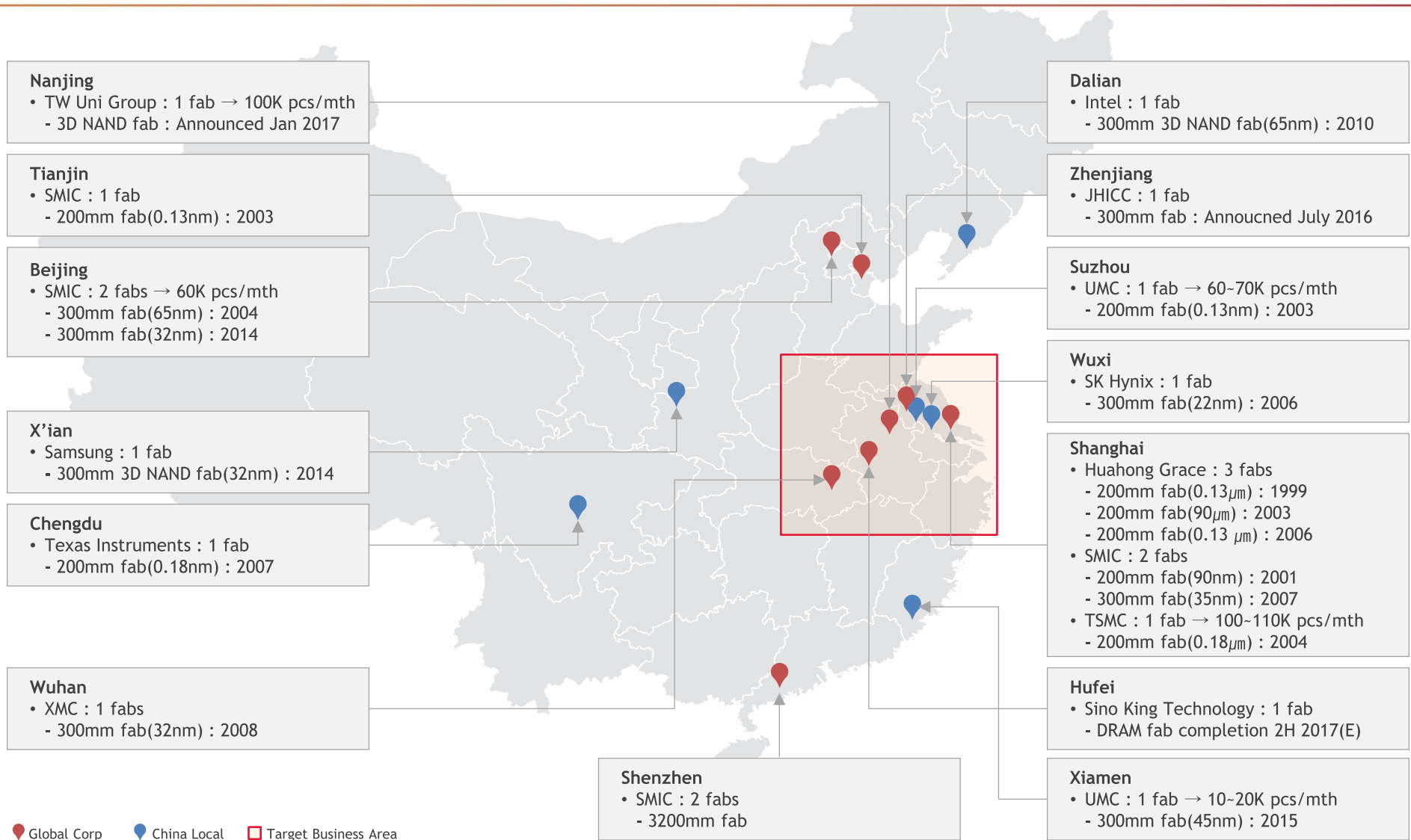
China Semicon./LCD Target Chemical Market Outlook

Target Chemical Demand in China Also Expected to Grow

- Similar product base for Semicon./LCD process chemical
→ Market size expected to grow to 700bn Won by 2019



3. China Semiconductor Investment Status



Market Insight- 기술을 상업적으로 결합하라
Global Specialty **MARKETER**

Session 2. Wireless Charging Business



1. Wireless Charging Technology Introduction

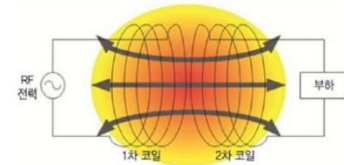
- Wider adoption of wireless charging application expected
- Wireless charging based on magnetic induction has been commercialized for various applications. Technology based on magnetic resonance currently under development with increased demand for long distance charging

Technical Characteristics

Magnetic Induction



자기유도방식 무선전력전송



자료: 한국전자통신연구원

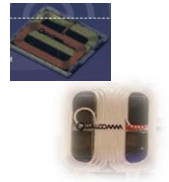
- Range: Short, mm~cm
- Capacity: W~KW
- Transmission Efficiency: 70~90%

Commercialization Status

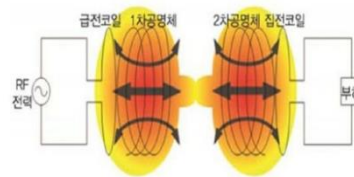
Used in wide range of mobile, home appliance, industrial applications

- Used for small electronic device as well as large capacity industrial equipment
 - wide transmission capacity ranging from couple of watts to hundred kilowatts
- Applied in smartphones and wearable devices
 - Samsung Galaxy S, Note series

Magnetic Resonance



자기공진방식 무선전력전송



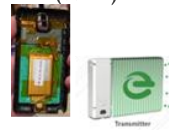
자료: 한국전자통신연구원

- Range: long, ~m
- Capacity: W~KW
- Transmission Efficiency: 40~80%

R&D since late 2000 and in early adoption stage for mobile/automotive application

- Long distance/multi-unit charging applicability for electric vehicle and mobile device under development
- Key hurdles for wider adoption include low charging efficiency and safety concerns

Electro Magnetic (Wi-Fi)



- Use Wi-Fi signal
- Range: long, max 8.5m
- Capacity: low, max 1W

Multiple venture companies developing technology for low energy application

- Longer charging distance than magnetic resonance
 - low charging efficiency and safety concerns act as hurdles for adoption
- Applicability under review for lower energy consuming IoT application

1. Wireless Charging Technology Introduction

- Wireless charging module consists of chipset, circuit, coil, and shielding sheet
- Mobile application development target thin/flexible form factor while automotive application target weight reduction/efficiency improvement

Wireless Charging Module Content

Consist of Chipset, Circuit, Coil, and Shielding Sheet

- Module maker provides final assemble and supplies to handset maker

Content	Role	Supplier
① Power Control Chip	Wireless charging control	TI, Qualcomm, etc.
② Power Control Circuit	Min. rectification/power loss	PCB/FPCB maker
③ Coil(Antenna)	Power transmission	Coil/CU foil maker
④ EMW Shielding Sheet	EMW shielding	Magnetic materials maker



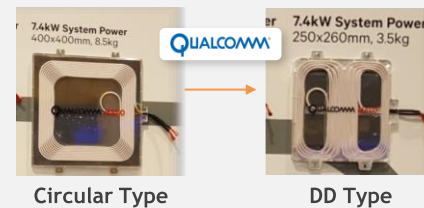
Key Development Trends by Application

Mobile : Thin & Flexible Form Factor

- Power transmission capacity : 1 ~ 20W (relatively low power transmission)
- Receiver(Rx) : Integrated solutions for mobile devices
→ Integrated in FPCB with slimmer mobile device form factor
 - Coil and Cu foil fabrication integrated in FPCB
 - NFC/MST(Samsung Pay) integrated to other antennas(3-Combo)
- Magnetic material evolving to allow for slimmer thickness and multi-shielding function (Ferrite → Amorphous → Nano Crystal)
- Transmitter(Tx) : Applied to coil and PCB board

Automotive : Weight Reduction/Efficiency Improvement of Shielding Sheet and Coil

- Power transmission capacity : 1~ 20 kW/System Weight : 2~5 kg
- Receiver(Rx) : Developing lower weight solution



8.5 kg → 3.5 kg

40cm X 40 cm →
25cm X 26 cm

2. Wireless Charging Market Trend

- Wider adoption of wireless charging in mobile application expected in 2017, with increased penetration in smartphone market

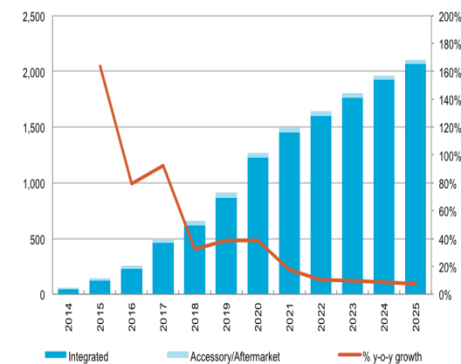
Market Trend

Wider Adoption in Mobile Application Expected in 2017

- Expect adoption for 1.7bn units by 2023

World charging receives in all application

Millions of units



Wireless charging enabled mobile device expected at 100mn units in 2017 and 1bn units by 2020

Continues Penetration Growth of Wireless Charging in Smartphones Expected

- Adoption limited to premium smartphones(Samsung Galaxy S) in 2016
- Wider adoption among global smartphone makers expected in 2017

Expansion of Wireless Charging Application

Wireless Charging for Mobile Devices Expanding

- Applied to health care products(electric razor, electric toothbrush)
→ Market rapidly expanding with increased mobile/IoT devices since 2010



Multiple Technology Adoption for Smartphone Wireless Charging

- Wireless charging currently limited to contact based MI technology. Expect wider technology adoption such as short-range charging

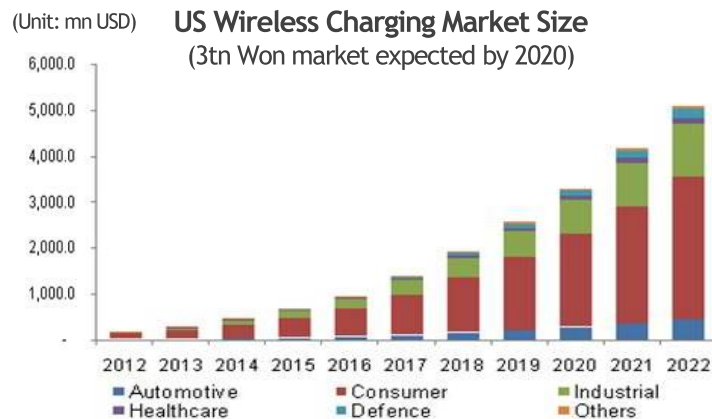


3. Future of Wireless Charging

- Global market size 2.6bn USD as of 2015. Expect over 20% CAGR going forward
- Future growth expected to be driven by industrial(factory automation) and mobility(autonomous vehicle) application

Market Trend

Wireless Charging Module Market is Experiencing Rapid Growth, with Adoption Expanding from IT Application to Industrial and Mobility Application



- Adoption expanding from mobile to industrial, military application
- 2015 global market size 2.6bn USD (US market size: 600mn USD)
- Global market expected to grow to 25bn USD by 2023

Source : Global Market Insights Inc. (2016)

Expansion of Wireless Charging Application

Factory Automation Leading to Wider Industrial Application

- Wireless charging expected to be applied to drones, robots, automobiles
- Currently applied for automated process in Semicon./display factories
- Market to grow with wider adoption in mobility, industrial, military application



Wireless Charger for Electric Vehicle to Lead Mid-Long Term Growth

- EV + autonomous vehicle technology expected to trigger rapid growth
- Wireless charging essential for autonomous vehicle



4. SKC Technology Introduction



Superfine 스카이 라이트 자성체와 축적된 코팅기술의 결과입니다.

■ 최고의 품질, 전문전산인용.

자체 생산 및 품질검사 기준을 더욱 강화한 SKC 최고의 품질로 100% Error Free 와 Full Lifetime 을 보증합니다.

■ SKC 오랜 경험의 노-하우

수퍼 바인더 시스템과 새로운 Superfine 스카이 라이트 자성체를 사용, 균일한 자성체의 배합과 성형으로 도막의 균일도 및 기록 신호의 안정도를 극대화했습니다.

■ 신제품 HIGH GRADE 소비자가격표

5.25INCH	HG— MD-2D	HG— MD-2DD	HG— MD-2HD	HG— MD-256HD
1PC	₩ 1,100	₩ 2,100	₩ 2,800	₩ 3,000

■ 디스크 보호용 뉴 패키지

자성체로 이루어진 디스크는 온도·습도·황·충격 등 외부조건에 매우 약하므로, 개발 못지않게 안전하게 보관하는 것 또한 중요합니다.

SKC HG 뉴 패키지는 2중 PVC 박스로 되어 있으며 디자인 또한 매우 미려하여 컴퓨터 주변기기로서 자리매도 손색이 없습니다.



플로피디스크 전국대리점 ■ 서울/이마트점 : 545-8813 ■ 백산점 : 273-6835 ■ 서울 : 234-1918, 8740
인천 : 234-4900 ■ 수원점 : 244-2009 ~ 7 ■ 지명점 : 272-4811 ~ 6 ■ 원주점 : 249-4547 ~ 5 ■ 부산 : (800) 881-2200, 803-2773 ■ 광주 : (02) 2100-1000 ■ 대구 : (051) 2100-1000 ■ 대전 : (042) 2100-1000 ■ 울산 : (052) 2100-1000
■ 대구/이마트점 : 244-1851 ~ 2 ■ 이마트점 : 253-1712 ■ 부산 : (051) 2100-1000 ■ 서울 : (02) 2100-1000
■ SKC PLAZA : (02) 274-3783 ~ 4 ■ 강남점 : 540-7240 ~ 3 ■ 동산점 : 713-6652 ~ 3

<http://comandqam.tistory.com/>

Core Technology

Magnetic
Material

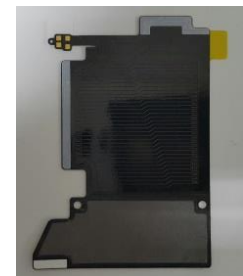
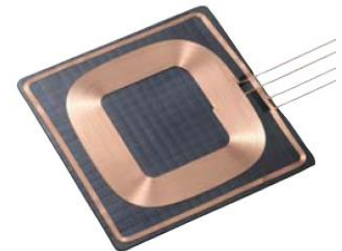
Ferrite

Nano-
Crystal

Polymer
Resin
Coating

M-FCCL

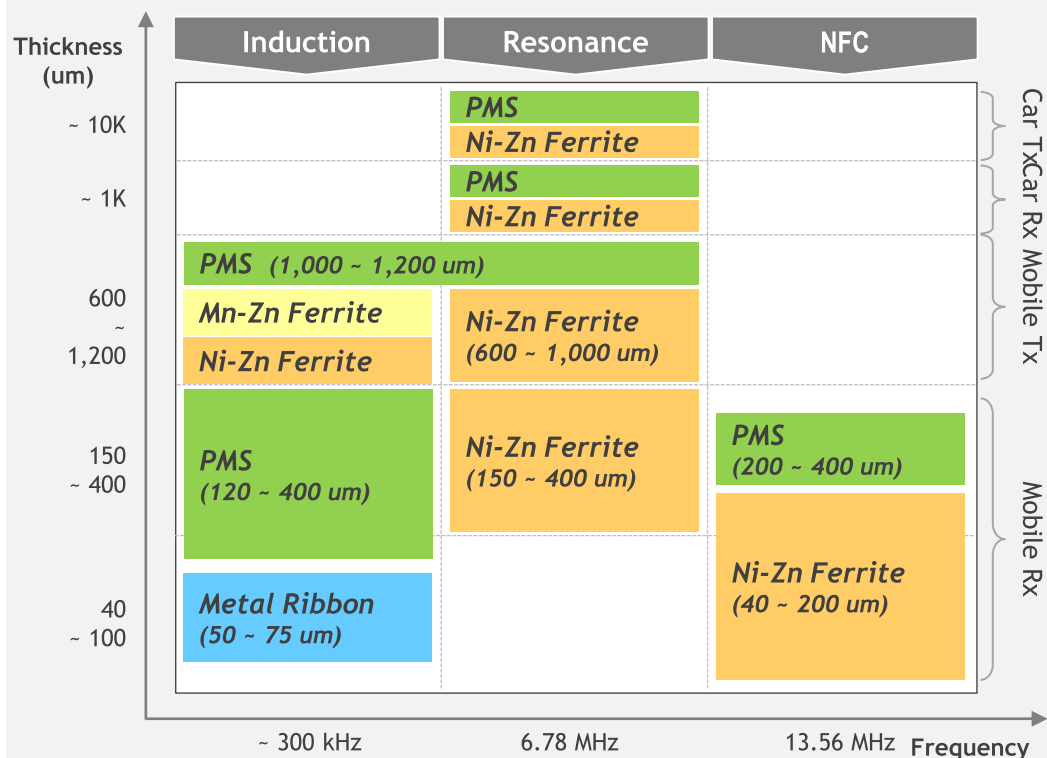
Product Line-Up



5. SKC Wireless Charging Business Status (1) Product Line-Up

SKC holds diverse product line-up of wireless charging related materials

Material Domain Map



Material Characteristics

Mn-Zn Ferrite

- Permeability : 1,500 ~ 10,000
- Frequency : 10 KHz ~ 1 MHz
- Low material cost, high processing cost

Ni-Zn Ferrite

- Permeability : 20 ~ 2,000
- Frequency : 200 KHz ~ 100 MHz
- High material cost, low processing cost
- Identical process with Mn-Zn Ferrite, except forming

PMS

- Permeability : 20 ~ 200
- Frequency : ~ 15 MHz
- High material cost, low processing cost
- Low Price (@ ~ 400 um)

Metal Ribbon

- Permeability : 200 ~ 8,000
- Frequency : ~ 250 kHz
- Advantage in slimming, limited thickening (~ 30 um)
- Difficult processing
- Amorphous / Nano-crystal material

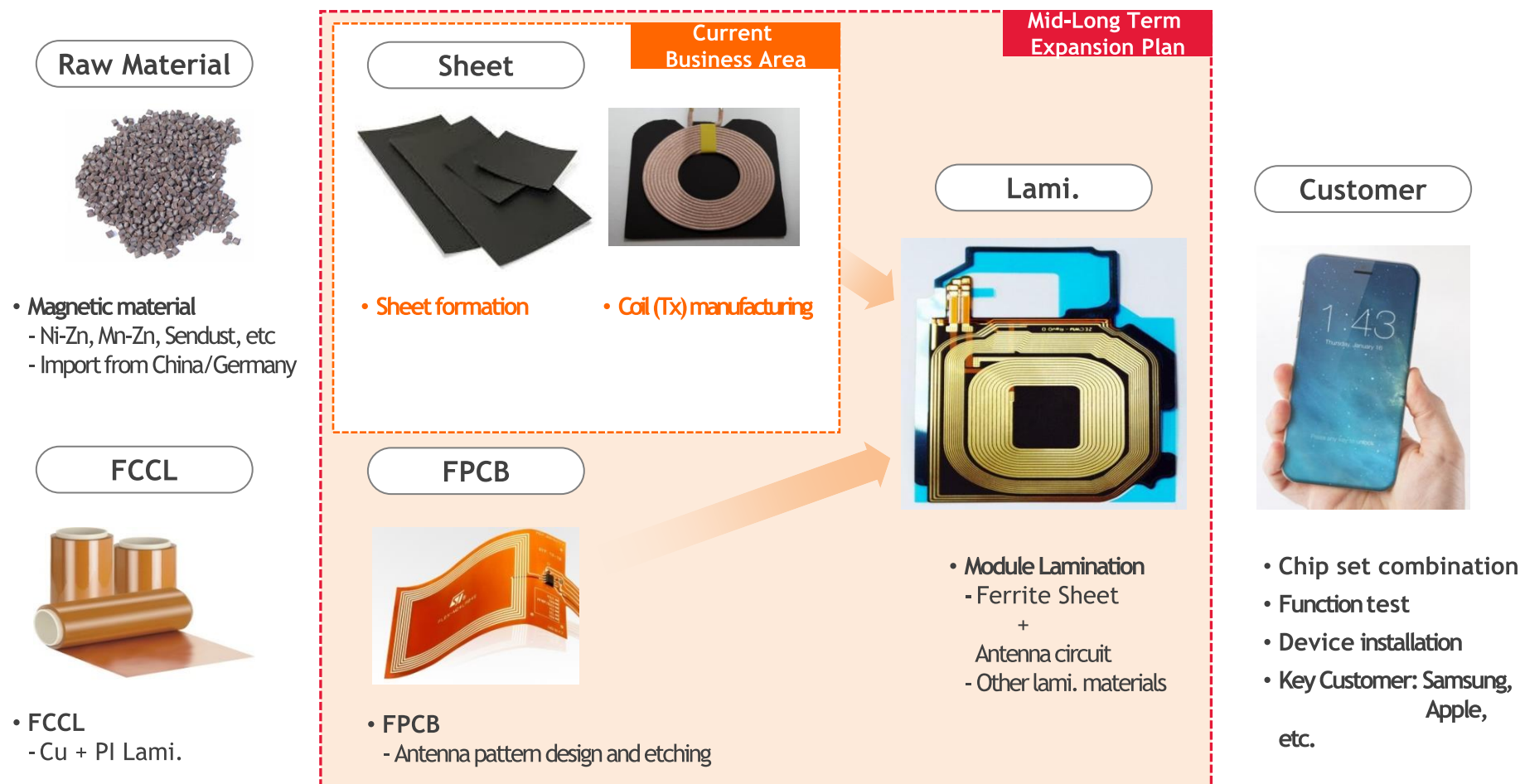
5. SKC Wireless Charging Business Status (1) Product Line-Up

SKC have expanded product line-up of wireless charging materials since 2014

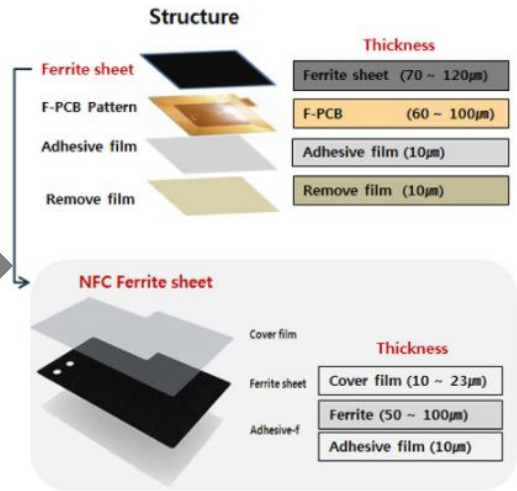
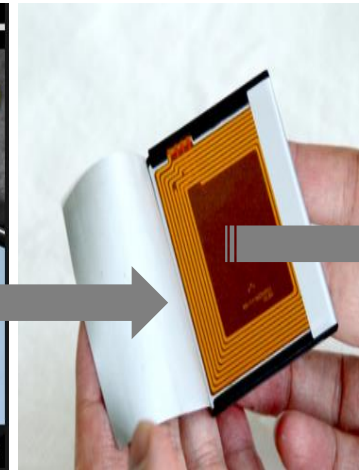
Commercial-ization	2014	2015					2016	2017
Material	Ni-Zn Ferrite	Mn-Zn Ferrite	PMS : Polymeric Magnet Sheet			Amorphous	Nanocrystal	M-FCCL Compound Material
SKC Product	SKFS GF Series	SKFS MN Series	PMS S Series (Sendust)	PMS C Series (Fe-Si-Cr계열)	PMS CIP Series	Amorphous + Ferrite Sheet	SK VN Series	SKyMAG Series
Application	NFC	WPC Tx	WPC Rx	NFC	RF Noise absorber	WPC Rx	WPC Rx	NFC+PAY
								
End Product	- NFC / RFID - Multiple models • Rx - High permeability Ni-Zn F/S developed 2017 → Supplied to global handset maker	- Tx - S6, S7, S8 Tx - Accessory - Automotive Tx - Furniture Tx	- Rx - IM100 - Watch - Accessory	- NFC / RFID - Tablet PC - WMI shielding sheet	High frequency EMW absorber	- Rx (Hybrid Type) - S6 Rx	- Rx - 3Combo (NFC+PAY+WPC) - S7, S8 Rx	• NFC+PAY -Compound material - FPCB+mg material → `17. A Series

5. SKC Wireless Charging Business Status (1) Product Line-Up

- Value chain for NFC, Samsung Pay(=MST) and wireless charging as per below
- SKC manufactures wireless charging material (sheet formation using magnetic material)



5. SKC Wireless Charging Business Status (2) Developing Product_IT



Main Product : Ni-Zn Ferrite Sheet

- Permeability: 100 ~ 200(at 13.56MHz)
- Thickness: 0.04 ~ 0.2mmT
- Saturated Magnetic Flux Density: 0.35~0.4T

SKC Next Generation Ni-Zn Ferrite Sheet

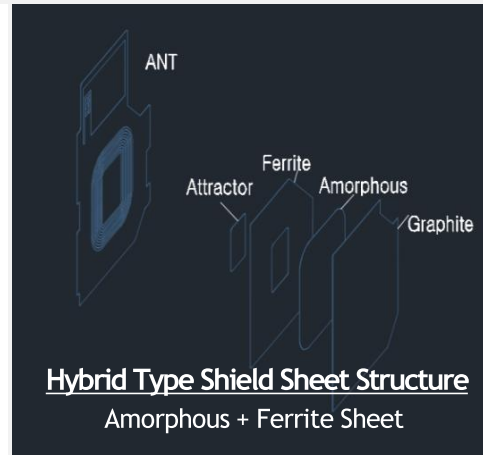
- Permeability: 700↑ (at 200kHz), Saturated Magnetic Flux Density: 0.6T
→ Mass production for overseas market in 2017



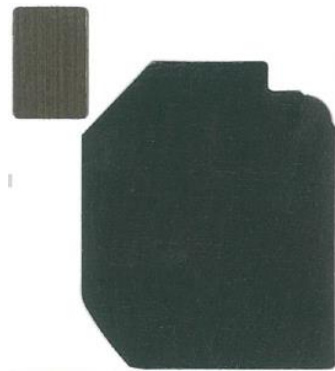
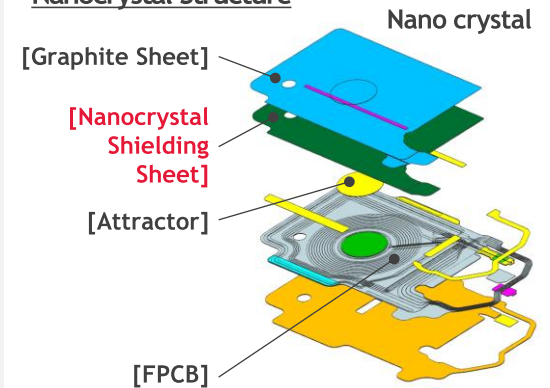
5. SKC Wireless Charging Business Status (3) Developing Product_Mobile



3Combo Product : NFC + MST + Wireless Charging



Nanocrystal Structure



Amorphous Shielding
/ Attractor



Ni-Zn Ferrite



Nanocrystal Shielding

Main Material : SKC Amorphous

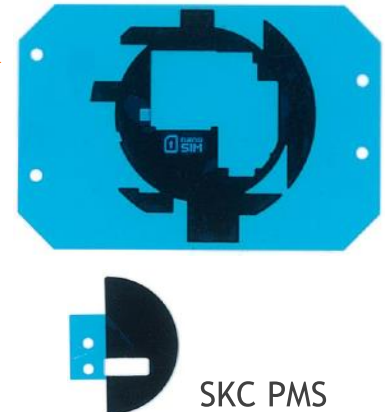
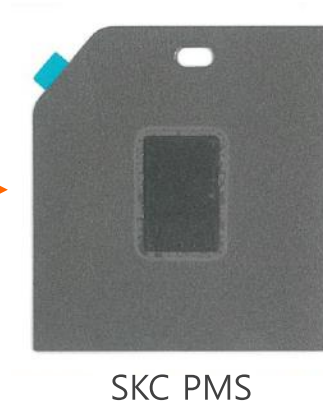
- Permeability: 350~500(at 200kHz)
- Thickness: 0.025mmT/Layer×3~5Layer
- Saturated Magnetic Flux Density: 1.35T

Main Material : SKC Nanocrystal

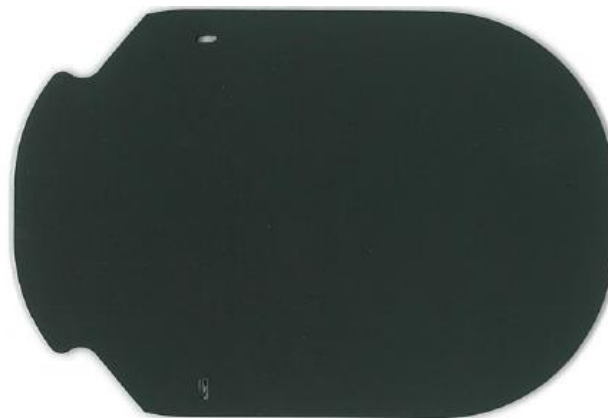
- Permeability: 600~1,000(at 200kHz)
- Thickness: 0.020mmT/Layer×3~5Layer
- Saturated Magnetic Flux Density: 1.25T

5. SKC Wireless Charging Business Status (3) Developing Product_Mobile

2Combo(Wireless Charging + NFC)



Wireless Charger



SKC Mn-Zn Ferrite

Main Material : SKC PMS

- Permeability: 100~250(at 3MHz)
- Thickness: 0.03~4.0mmT
- Saturated Magnetic Flux Density: 0.5T

Main Material : SKC Mn-Zn Ferrite

- Thickness: 0.3~40mmT
- Saturated Magnetic Flux Density: 0.5T

5. SKC Wireless Charging Business Status (3) Developing Product_Automotive



Wireless Charging Rx



Mn-Zn Ferrite

Wireless charger for Electric Vehicle

→ Demand of ferrite : High flux density and Low loss material for High efficiency



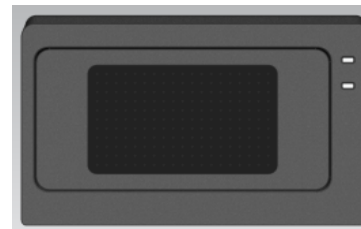
Module



A12 & 20 1-Coil



A6 / A13 / A28
3-Coil



A19 2-Coil



A16 1-Coil

Coil
+ Magnetic
Sheet



5. SKC Wireless Charging Business Status (3) Developing Product_M-FCCL

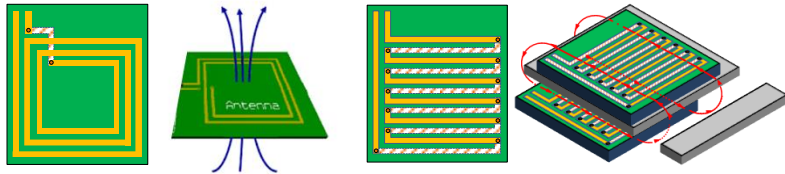
M-FCCL Antenna Module

M-FCCL : Magnetic Flexible Copper Clad Laminate

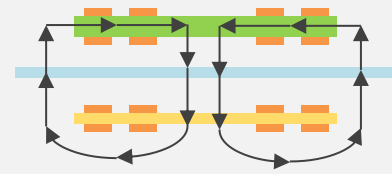
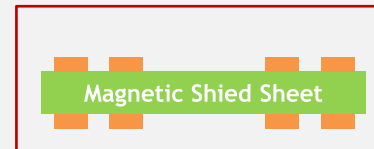
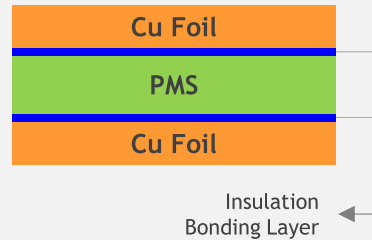
- Structure: Cu / Insulation Bonding Layer / PMS / Insulation Bonding Layer / Cu
- NFC / Samsung Pay / Wireless Charging Antenna Module Circuit Material

M-FCCL Application Advantage

- Slim Form Factor ($\Delta 25\%$) : No bi-side adhesive type, PI Insulation shield
- Cost Down ($\Delta 20\%$) : No laminating process
- Circuit design flexibility $\rightarrow$ Differentiated antenna design
: Improve Samsung Pay function and metal case architecture

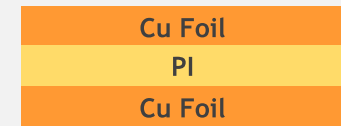


M-FCCL

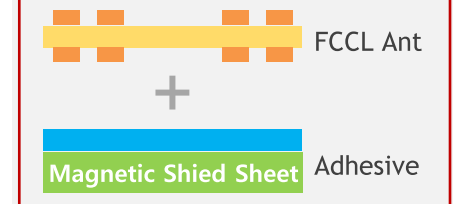


Standard Antenna Module

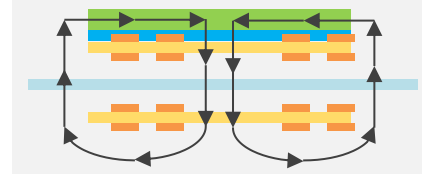
Standard FCCL



Standard FCCL antenna



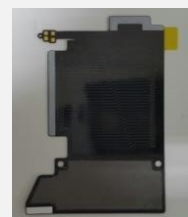
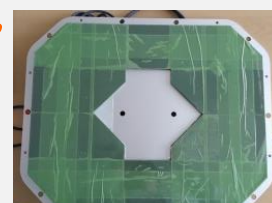
Magnetic Shield Sheet: Ferrite, PMS, Amorphous, Nano Crystal



6. SKC Wireless Charging Business Strategy



Pursue growth based on diversified material product base

	Customer	Future Strategy
IT/Mobile	Handset Maker	• M-FCCL based module business : Wireless Charging Material → Wireless Charging Module • Meet customer needs for slimmer form factor and flexibility 
EV & Infra	Automotive Maker	• Develop lighter weight higher energy transmission material for Automotive customer : High speed charging, light weight, Crack prevention • Mid-long term R&D - EV Infra : Road, Tram - EV Charging Infra set-up Existing Mn-Zn Ferrite  SKC EV Compound Material 
Smart Factory	Factory Automation Maker	• Expand wireless charging module targeted for factory automation • Supply wireless charging solution for automated semicon. Mfg. facility

Market Insight과 기술을 창의적으로 결합하는

Global Specialty **MARKETER**



THANK YOU!

