



# 极思新材料

## CMP PAD Introduction

2023.08



# Contents

Confidential



01 · Introduction of CMP Pads

02 · Major Product Portfolio

03 · Advantages of CMP Pad



# 01

## Introduction of CMP Pads

## “ Similar but Different ”

### CMP Performance

Composition Design Flexibility  
Pore Design variety  
Casting Process Uniformity  
Stack structure Control

Adjusting CMP performance  
To meet customer needs

### Lower Defect and Scratch

Softer composition and Small pore  
New Conditioning System  
(shape memory)

Longer Lifetime  
Lower Defect and Scratch

### Eco-Friendly CMP Pad

Cl (Chlorine) Free CMP Pad  
Recyclable CMP Pad

Hazardous chemical reduction  
CMP Pad Recycling System

# 01 Introduction of CMP Pads

## Development Concept

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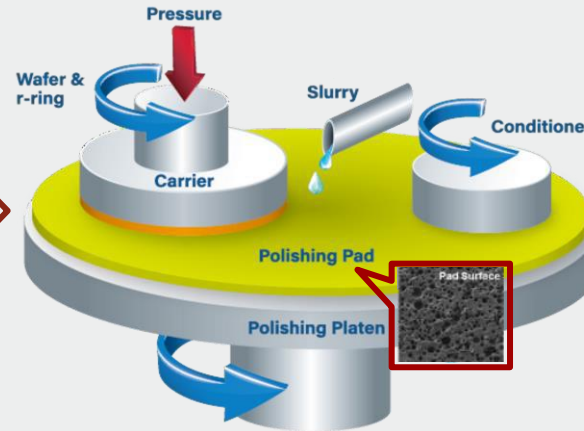
### Material Properties Control

Molecular Design Optimization

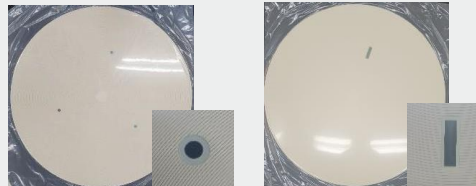
Pad Hardness Control  
(Surface Hardness, Pad Stiffness)

Wear Characteristics Optimization  
(Modulus, Tensile Stress, Elongation)

Thermal Properties Control  
(Hardness as temperature, DMA)



+ Window design



### Contact Properties Control

Pore Structure  
Groove / Stack Dimension  
Optimization

Pore Structure Optimization

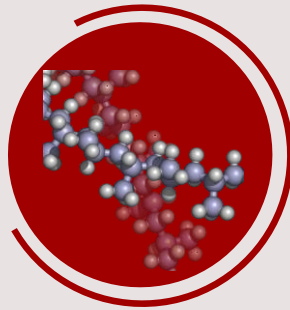
Groove Design Optimization

Real Contact Area Control as  
compressive force

Surface Roughness Optimization  
by CMP Conditioning

## Target Pad Development

### Material property control

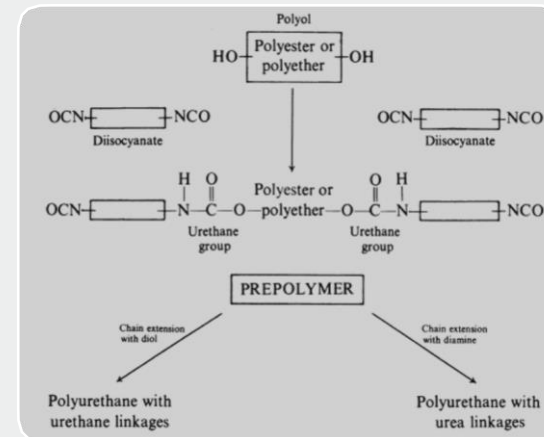


#### ◆ Polyurethane

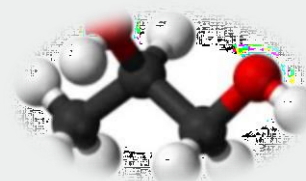
- Prepolymer Design
  - Isocyanate tech.
  - Polyol structure design/Synthesis
  - Extender tech.
  - Additive tech.
- Curing Agent Design
  - Reaction type selection
  - Eco-friendly concept adoption

#### ◆ Prepolymer self-designed and manufacturing

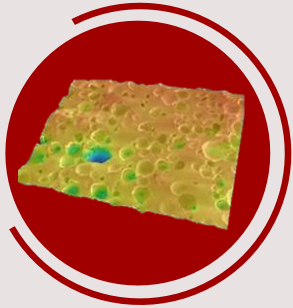
: physical, wear and thermal property controllable through own polyurethane system



Internal business network for raw material to ensure supply and development



### Contact property control

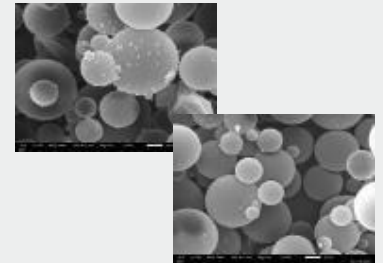
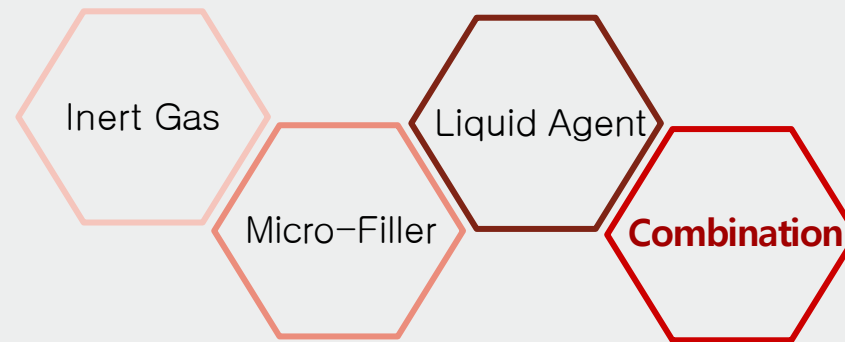


#### ◆ Pore generation method

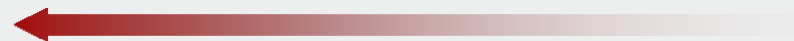
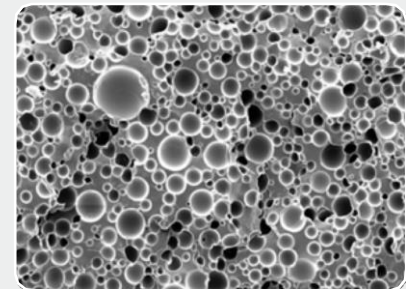
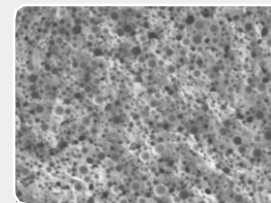
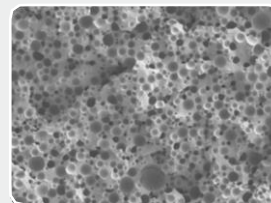
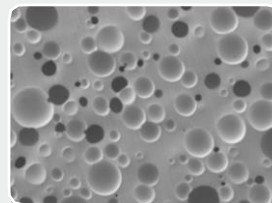
- Gas foaming tech.
- Liquid foaming tech.
- Solid foaming tech.
- Mixed foaming tech.

#### ◆ Pore system (hybrid pore system)

- : adjust various range of pore size (15~60um) and distribution via  
4 types of pore foaming technology – gas, liquid, solid, mixture
- Inorganic contamination reduced compared to micro-filler (solid) only system



Combination



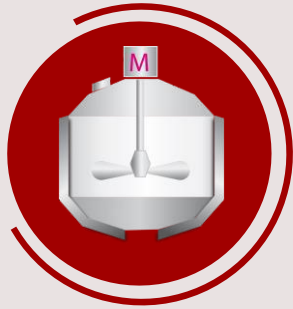


# 01 Introduction of CMP Pads

## Key Technology\_ High Dispersion Mixing System

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### Advanced Mixing Control



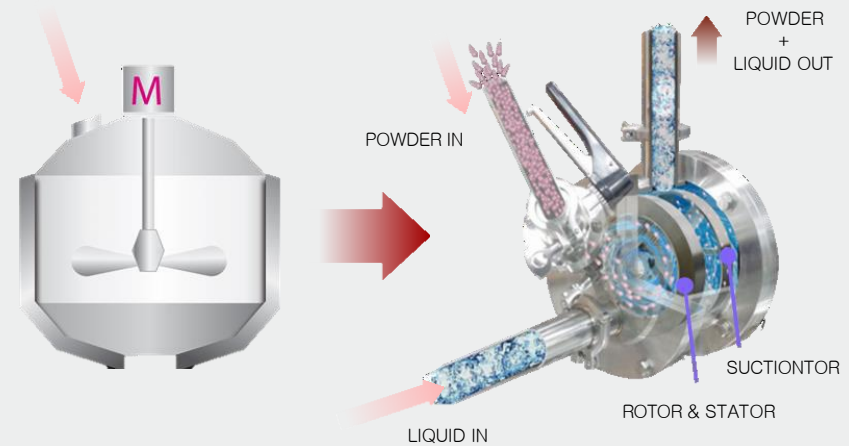
#### ◆ Inline Feeding Homogenizing

- Improve dispersion effect
- Minimizing contamination



#### ◆ High Dispersion Mixing System

: More uniform pore distribution and lower contamination of the pad





# 01 Introduction of CMP Pads

## Key Technology\_Sheet Casting System

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### Manufacturing System



#### ◆ Sheet casting by continuous feeding

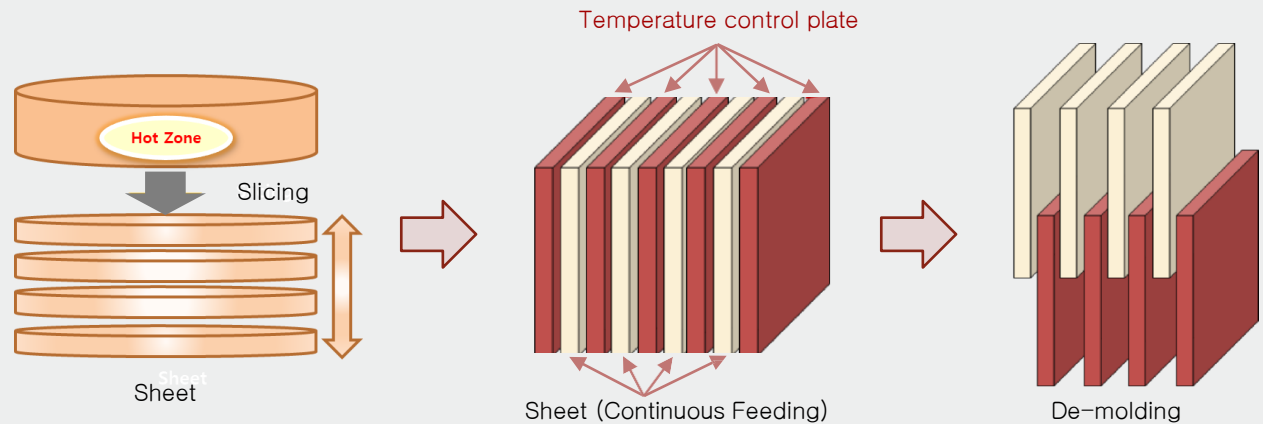
- Uniform temp. control in whole sheet
- Minimize sheet-to-sheet difference
- Good at quality monitoring/tracing
- Enable wide range of composition and various type of pore structure

#### ◆ Sheet Casting System

: provide minimized quality variation through continuous single sheet casting system

Uniform Temp. control

Uniform sheet material property  
(within Sheet & Sheet to Sheet)

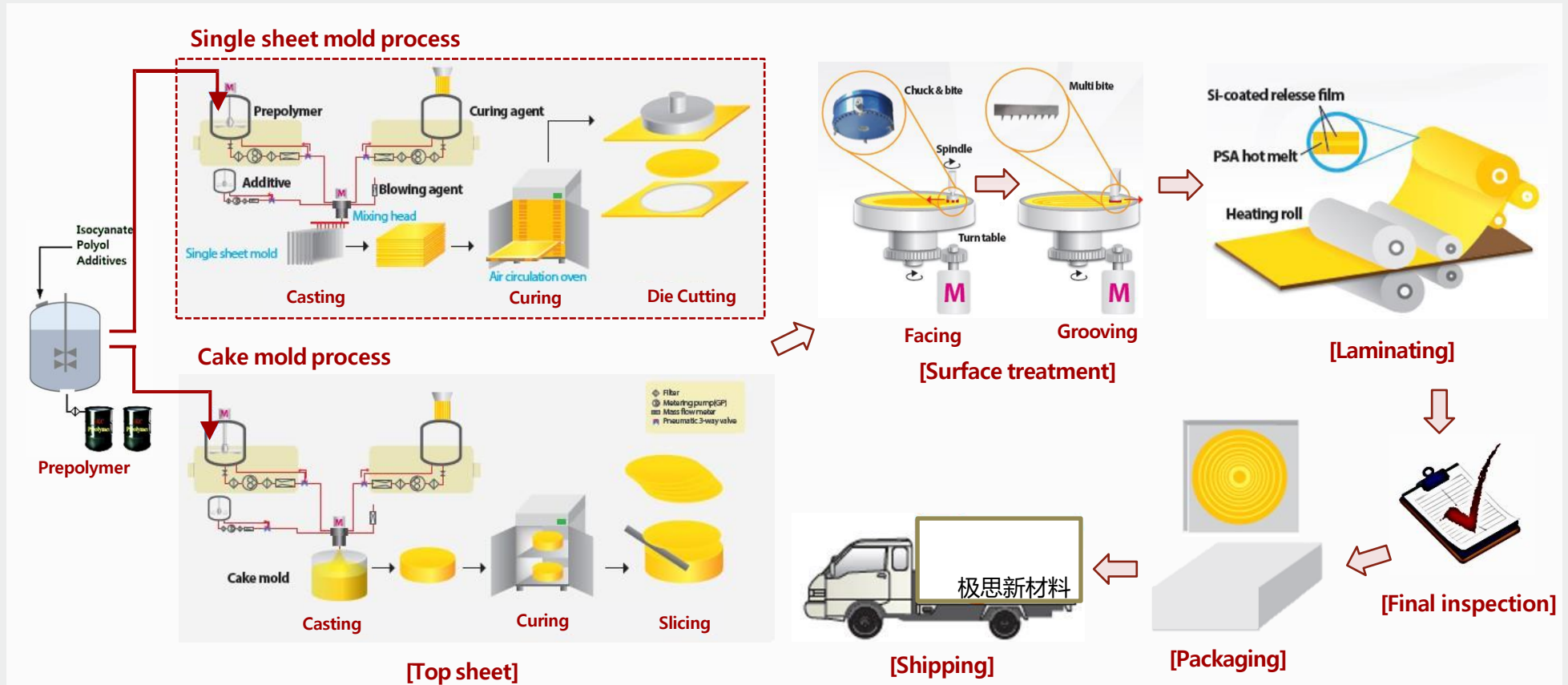


# 01 Introduction of CMP Pads

## Key Technology\_Casting Process

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### ◆ Manufacturing Process for CMP Pad



# 02

## **Major Product Hard Pad Portfolio**



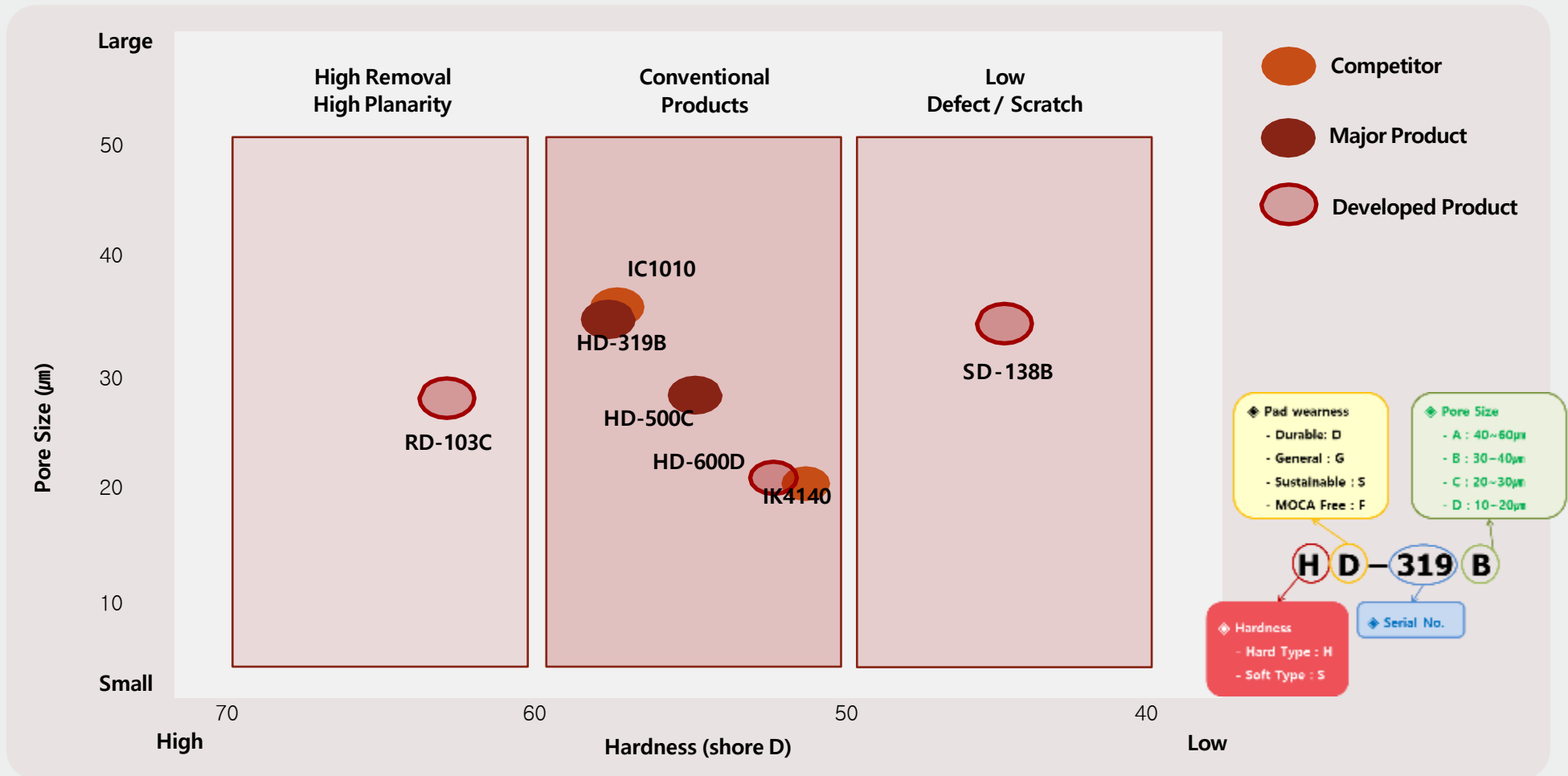
# 03 Major Product (Hard Pad) Portfolio

## Product Portfolio

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### ◆ CMP Pads

: Hardness (40~65D), Pore Size (15~50  $\mu\text{m}$ ), Window/Non-window type



# 03 Major Product (Hard Pad) Portfolio

## Major Product\_HD-319B

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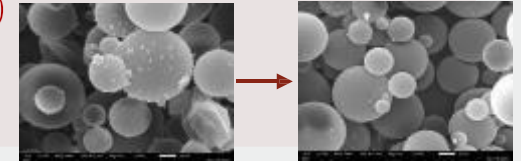
### ◆ Conventional Type CMP Pads

#### Composition and Physical Properties

- Composition  
: Polyurethane-based composition (SKe self-developed)
- Physical Properties  
: Similar to Reference Pads  
(Hardness, Tensile Strength, Elongation and Thermal Properties etc)

#### Pore Generation concept

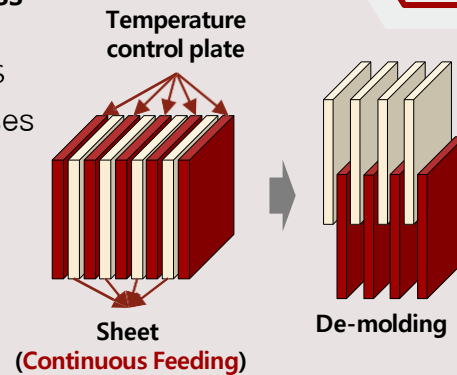
- Size and Density  
: Similar to Reference Pads
- 1:1 Mixed Pore System (Micro capsule and Inert gas)
- Contamination Controlled Pore System  
(Less Inorganic content)



HD-319B

#### Manufacturing Process

- Sheet Type Process  
: Uniformity increases  
and Good Quality  
Control



#### Stack Structure and Groove Design

- Stack Structure  
: Similar to Reference Pads  
(Controllable for customer needs)
- Groove Design  
: Circle type, 10% more in Depth for Pad Lifetime  
(Controllable for customer needs, XY, Radial also Possible)



※ Reference Pad : IC-1010 (DuPont)

# 03 Major Product (Hard Pad) Portfolio

## Major Product\_HD-500C

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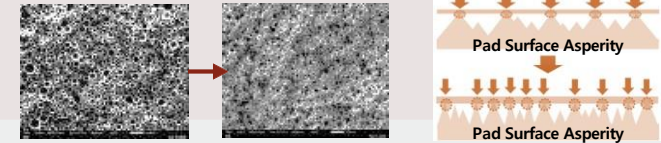
### ◆ Advanced Type CMP Pads (Lower Defect and Scratch Performance)

#### Composition and Physical Properties

- Composition
  - : Polyurethane-based composition (SKe self-developed)
- Physical Properties
  - : Softer Hardness (-3~4 Shore D)
  - (Tensile Strength, Elongation and Thermal Properties similar to Reference Pad)

#### Pore Generation concept

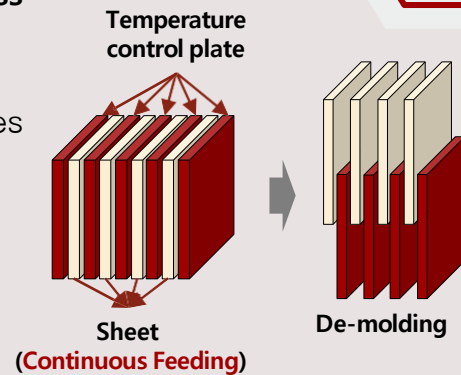
- Size and Density
  - : Smaller size and higher Pore Density
  - (Stress Mitigation for Each contact)
- 1:1 Mixed Pore System (Micro Capsule and Inert gas)
- Contamination Controlled Pore System



HD-500C

#### Manufacturing Process

- Sheet Type Process
  - : Uniformity Increases
  - and Good Quality Control



#### Stack Structure and Groove Design

- Stack Structure
  - : Similar to Reference Pads
  - (Controllable for customer needs)
- Groove Design
  - : Circle type, 10% more in Depth for Pad Lifetime
  - (Controllable for customer needs, XY, Radial also Possible)

※ Reference Pad : IC-1010 (DuPont)

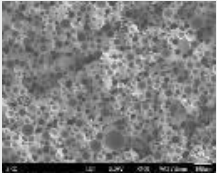
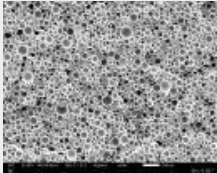
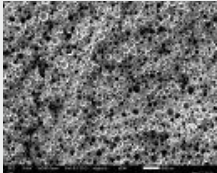





# 03 Major Product (Hard Pad) Portfolio

## Hard Pad\_HD-319B & HD-500C

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### ◆ Basic Property Comparison

Item		Unit	Dow (IC-1010_AT6)	极思新材料(HD-319B)	极思新材料(HD-500C)
Top Pad Physical Properties	Thickness	mm	2.0	2.0	2.0
	Density	g/cm <sup>3</sup>	0.80	0.80	0.75
	Hardness	Shore D	55~58	56~59	53~57
	Tensile Strength	N/mm <sup>2</sup>	19~22	20~22	20~22
	Elongation	%	70~100	80~100	70~100
	Pore Image (SEM)	—			
Groove	Pattern	—			
	Width/Depth/Pitch	mm	0.44/0.75/3.0	0.46/0.85/3.0	0.46/0.85/3.0
Sub Pad	Thickness	mm	1.3~1.4	1.3~1.4	1.3~1.4
	Hardness	Asker C	—	68~76	68~76
	Compressibility	%	—	8~11	8~11
Stack Pad	Thickness	mm	3.4~3.6	3.3~3.5	3.3~3.5
	Compressibility	%	0.6~1.2	0.8~1.2	0.8~1.2
Recommend Use			Standard Pad	For Silica Slurry	For Ceria Slurry

# 03 Major Product (Hard Pad) Portfolio


## Hard Pad\_HD-319B & HD-500C

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### ◆ Evaluation Pads



### ◆ Evaluation Instrument

CMP Tool	Pad Analysis
 <p>Polisher (CTS, AP-300)</p>	  <p>3D-Roughness (Bruker, Contour GT)</p> <p>SEM (JEOL, JSM-IT300)</p>
Removal Rate, Polishing Parameter, Defect Inspection	Surface Roughness, Surface Image

### ◆ Polishing Condition : W/Oxide (Si, Ce)

Category	Detail	Spec.
Wafer	Wafer type	PETEOS
	Dummy (Polishing time/Number of time)	40s/8
	Monitoring (Polishing time/Number of time)	60s/2
Break In	Time	15min
Head & Platen	Head speed(rpm)	87
	Head pressure(psi)	3.5
	Platen speed(rpm)	93.0
	Spindle sweep speed(sw/min)	19.0
Conditioner	Conditioner type	CI45(Shinhan)
	Conditioning type	In situ + Ex situ
	Conditioner force(lb)	6.0
	Conditioner rpm(rpm)	101.0
	Conditioner sweep speed(sw/min)	19.0
Slurry	Slurry type	W7573/LSW /ACS-580/DIW
	Slurry recipe	Pure/Slurry : DIW(1:9)/Pure
	Flow rate(cc/min)	200/200/500

# 03 Major Product (Hard Pad) Portfolio

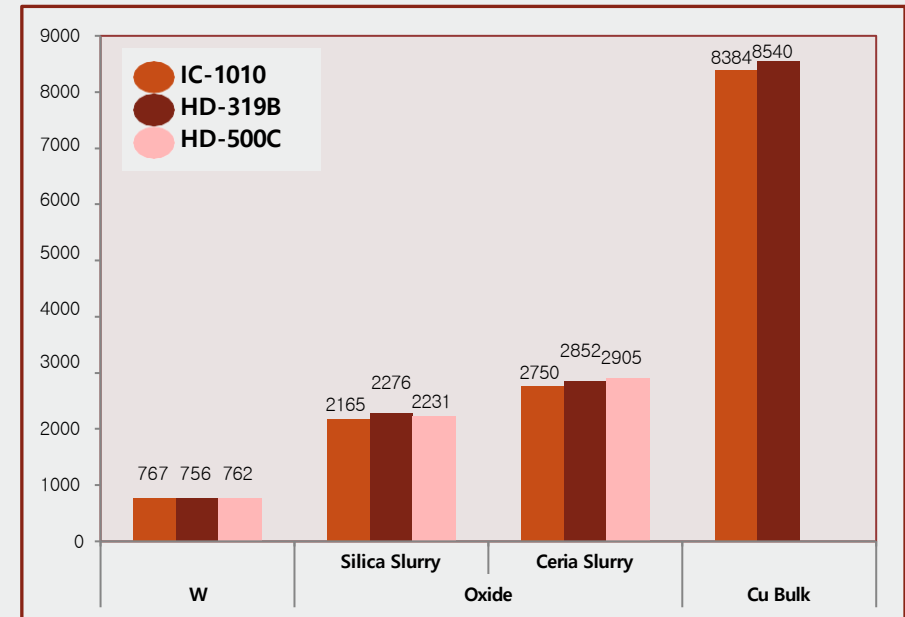
## Hard Pad\_HD-319B & HD-500C: Removal Properties

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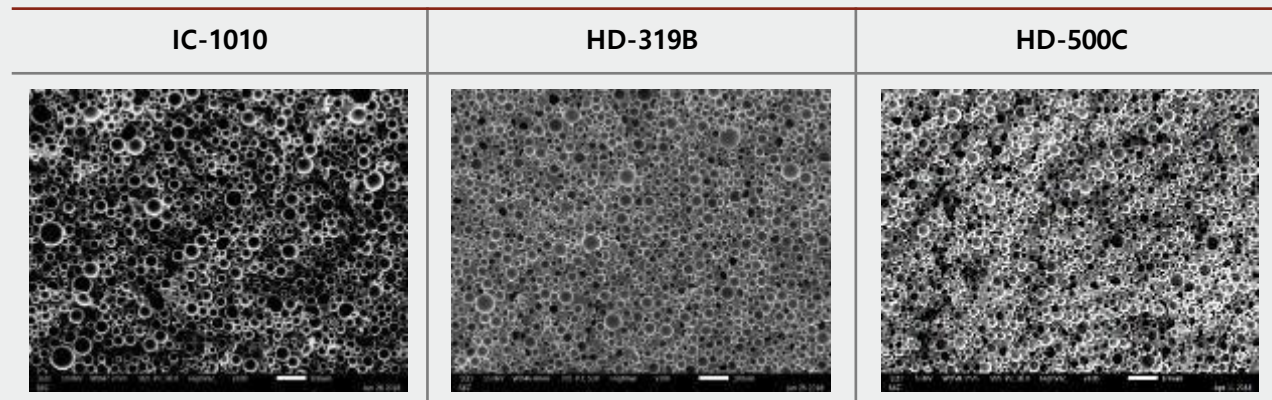
### ◆ Target application layer

CMP Layer		DRAM		FLASH (3D)	
		Reference	SKe	Reference	SKe
Oxide	STI	IC-1010(D)	HD-500C	IC-1010(D)	HD-500C
	ILD			E6088(C)	
W	Bulk	HD-319B			
	BM Buffing				
	Touch				
Cu	Bulk				

### ◆ Removal Rate (Å/min)



### ◆ Pore Image (SEM)



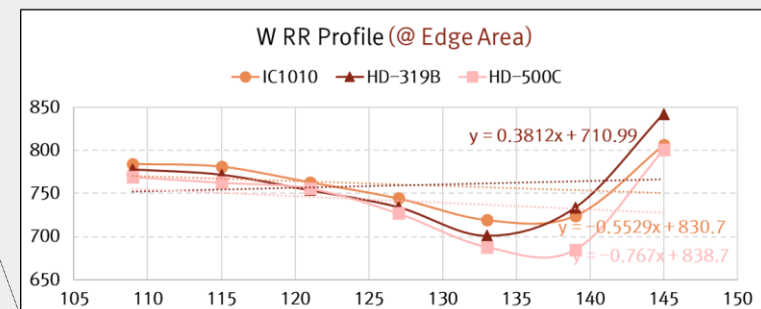
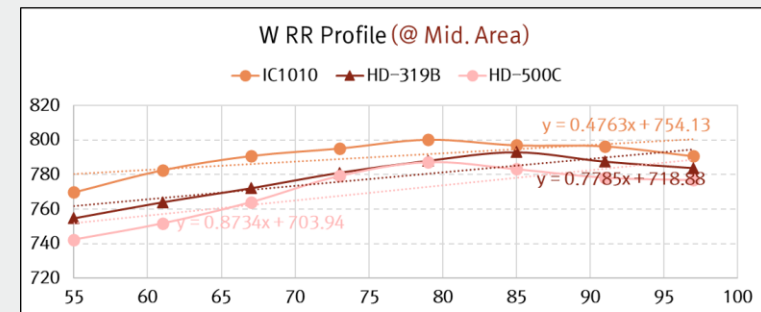
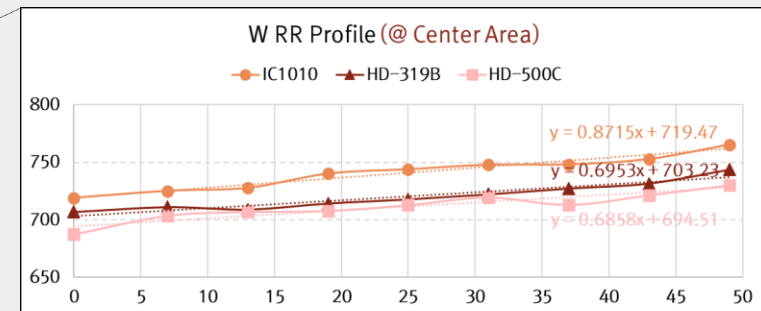
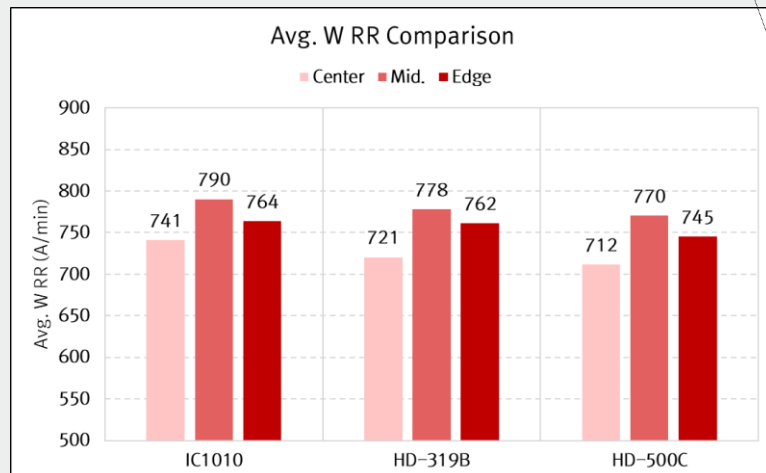
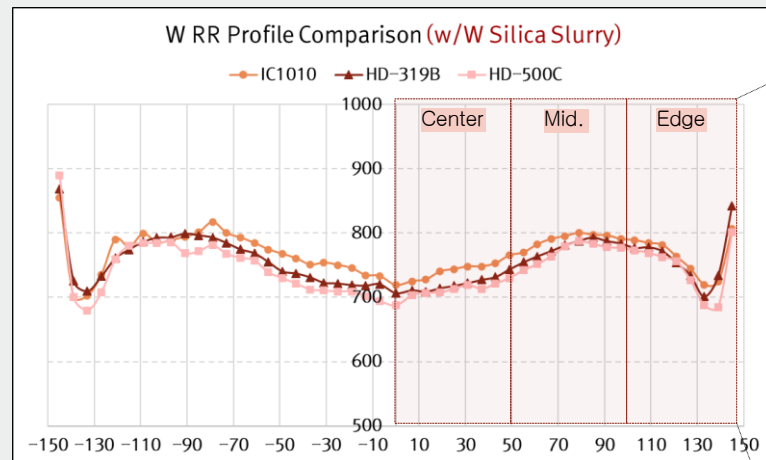


# 03 Major Product (Hard Pad) Portfolio

## Hard Pad\_HD-319B & HD-500C: W CMP Performance

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- ◆ **WRR** : Comparable (IC1010  $\doteq$  HD-319B  $\doteq$  HD-500C)
- ◆ **Wafer Profile** : Comparable (IC1010  $\doteq$  HD-319B  $\doteq$  HD-500C)



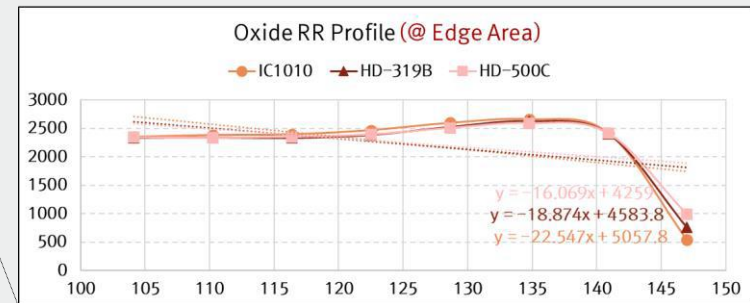
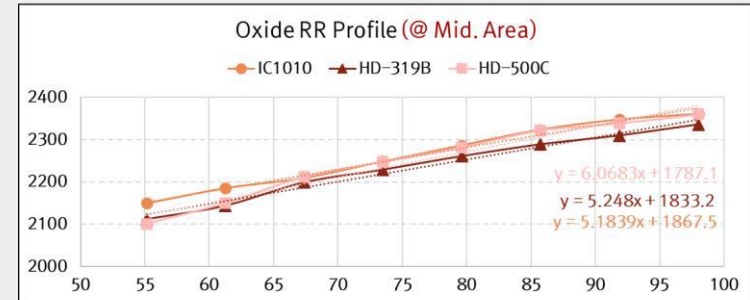
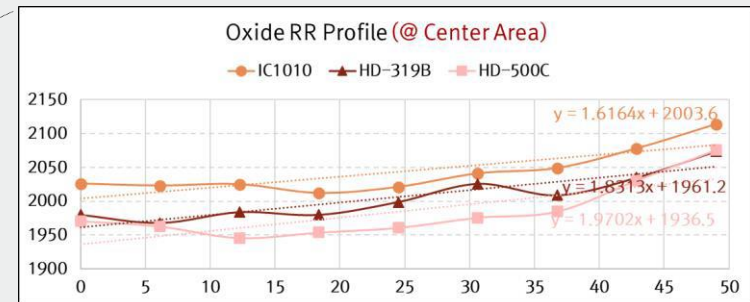
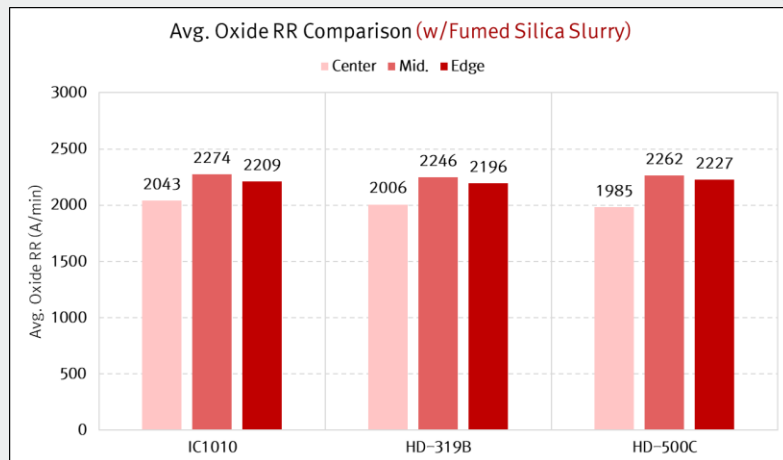
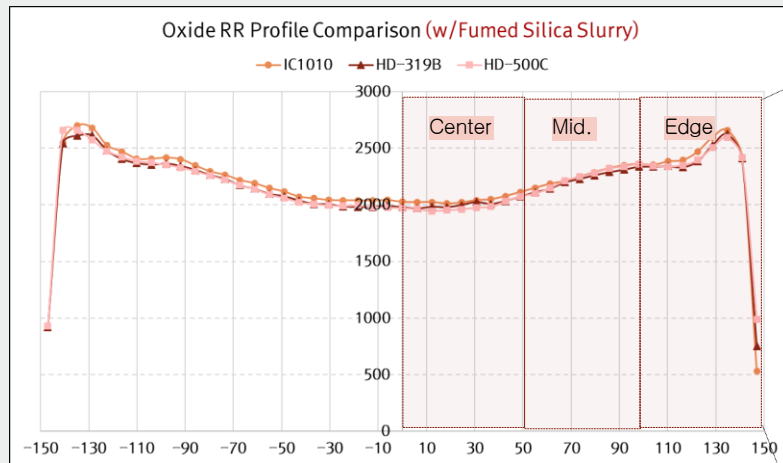
# 03 Major Product (Hard Pad) Portfolio

## Hard Pad\_HD-319B & HD-500C: Silica Slurry

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◆ **Oxide RR w/Silica Slurry** : Comparable (IC1010  $\doteq$  HD-319B  $\doteq$  HD-500C)

◆ **Wafer Profile** : Comparable (IC1010  $\doteq$  HD-319B  $\doteq$  HD-500C)



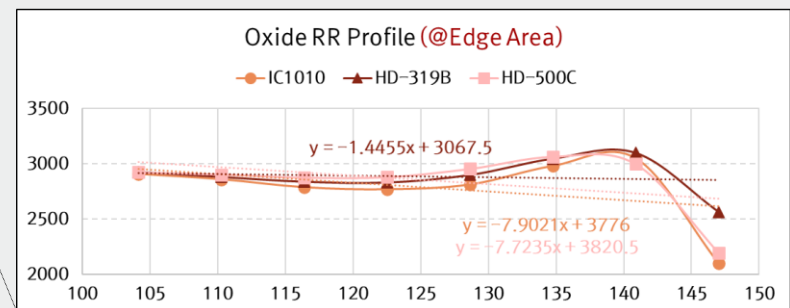
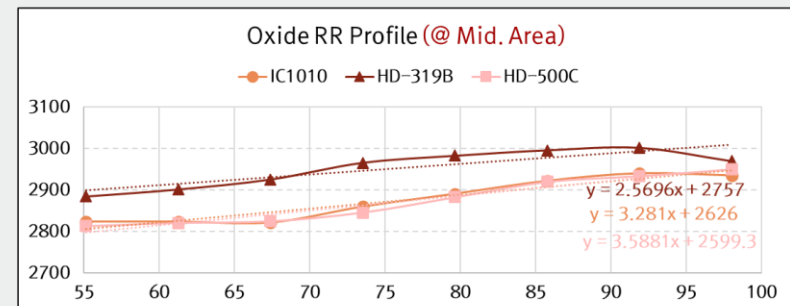
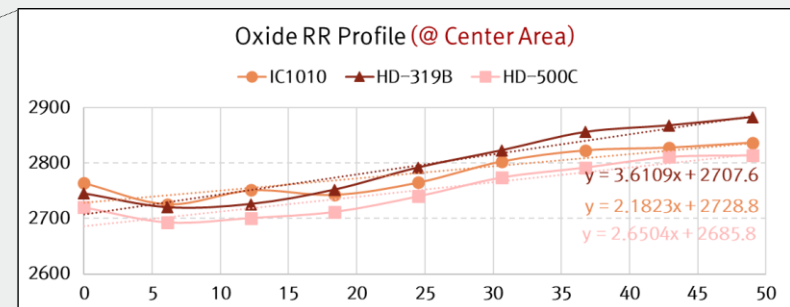
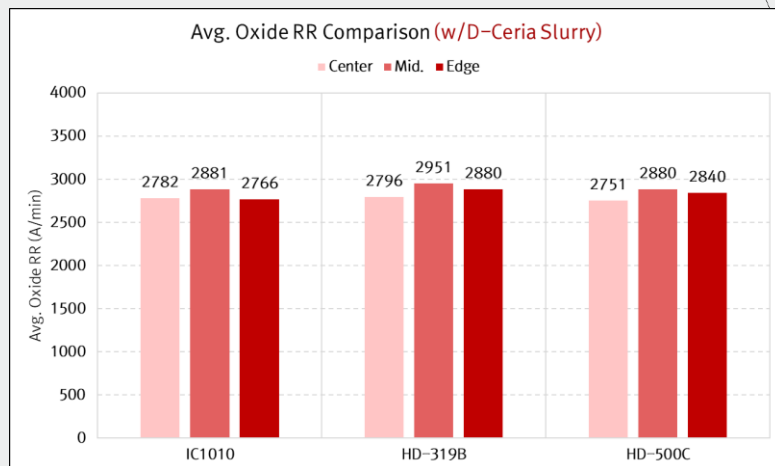
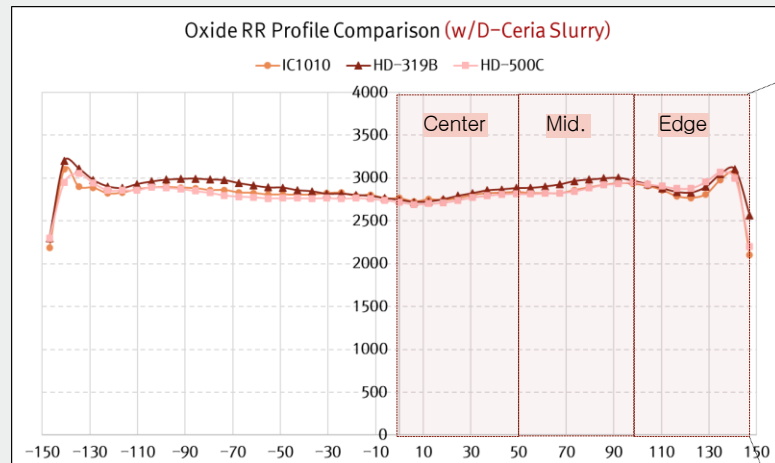
# 03 Major Product (Hard Pad) Portfolio

## Hard Pad\_HD-319B & HD-500C: Ceria Slurry

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◆ **Oxide RR w/Ceria Slurry** : Comparable (IC1010 ÷ HD-319B ÷ HD-500C)

◆ **Wafer Profile** : Comparable (IC1010 ÷ HD-319B ÷ HD-500C)





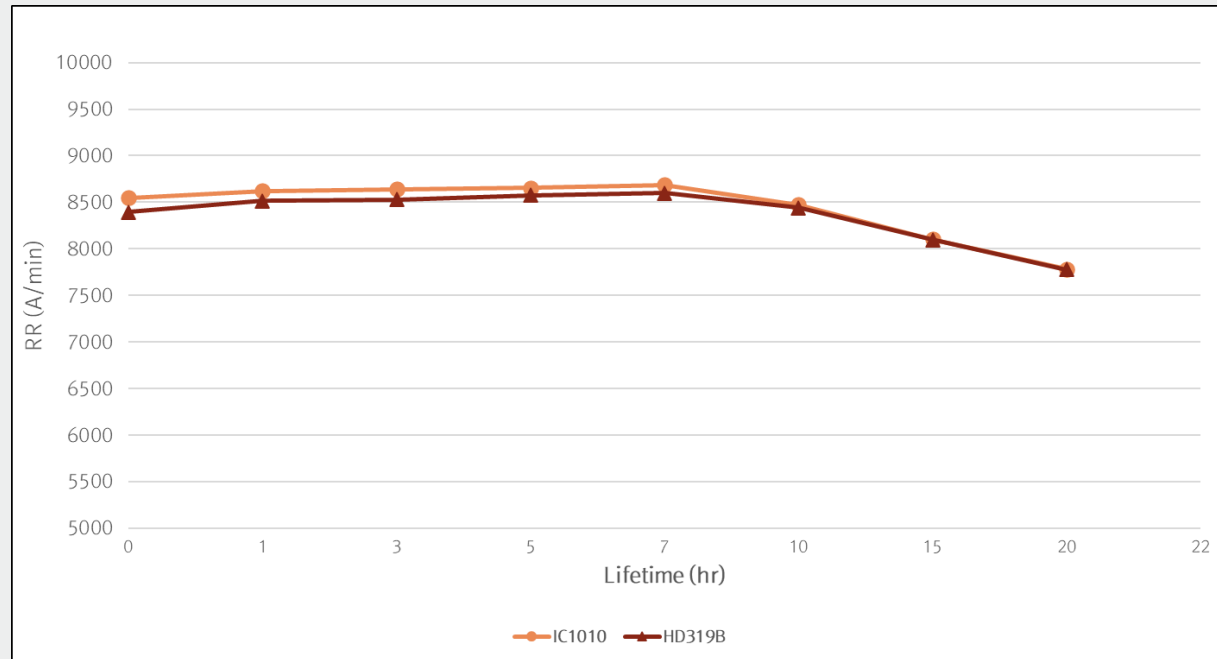
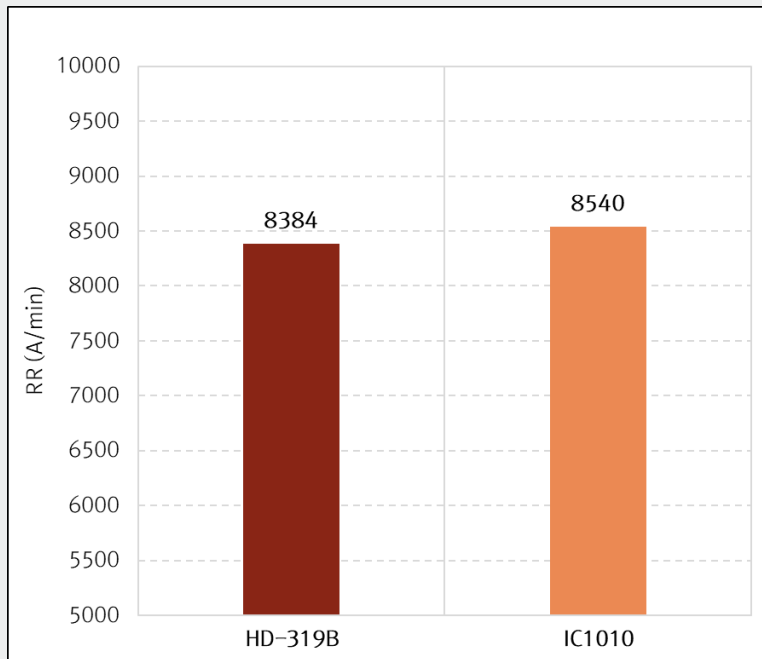
# 03 Major Product (Hard Pad) Portfolio

## Hard Pad\_HD-319B & HD-500C: Cu CMP Performance

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### ◆ Similar Cu removal performance to IC-1010

- **Slurry** : 9044C [DI 875.3ml : Slurry 94.3ml : 30ml], flow Rate 250 ml/min
- **Conditioning disk**: D92, disk speed 108 rpm (in-situ), disk down force 7 lbf
- **Head pressure**: 2.6 psi, Head speed 87 rpm, Platen speed 99 rpm
- **Polishing time** : 60sec



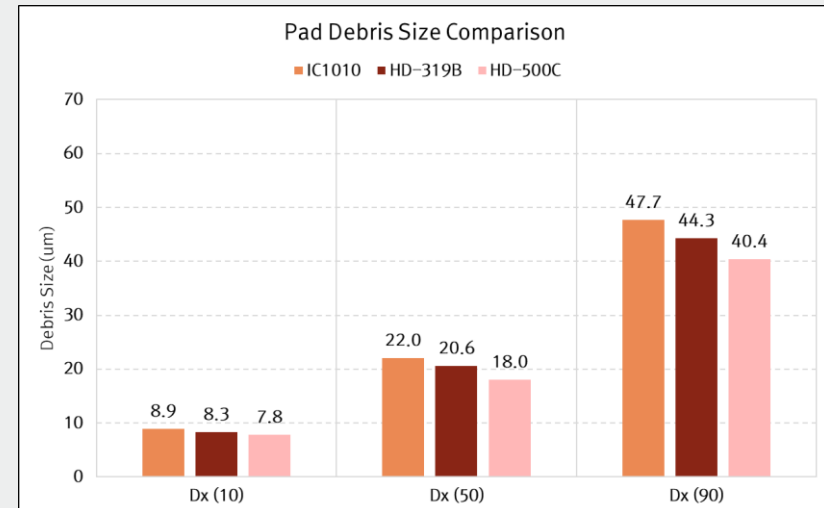
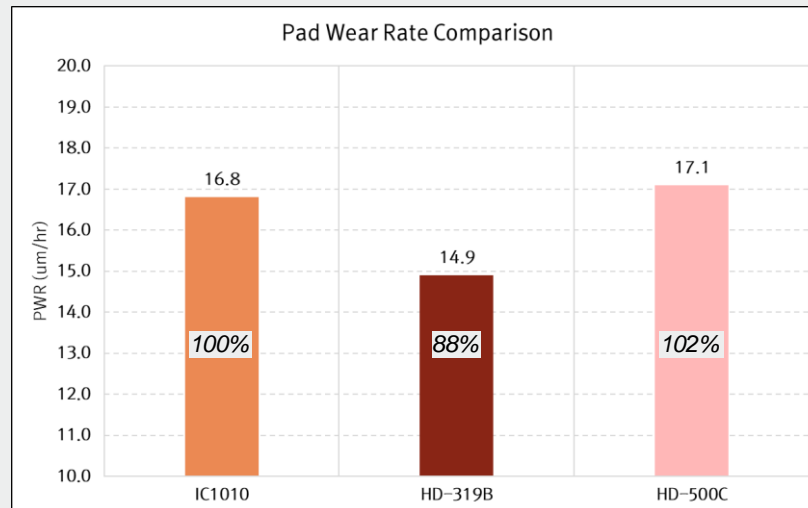
# 03 Major Product (Hard Pad) Portfolio

## Hard Pad\_HD-319B & HD-500C: Longer Pad Lifetime

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### ◆ Pad wear rate and debris size comparison (Results from internal test)

- HD-319B pad : **longer lifetime** with 10% lower PWR
- HD-500C pad : **lower defectivity** made by smaller debris (comparable PWR to IC 1010)



### • Test Conditions for PWR measuring

Time (min)	30 (4times)
Platen Speed (rpm)	93
DIW Flow Rate (cc/min)	300
Disk type	DI45 (Saesol)
Conditioner Force (lbf)	6
Conditioner rpm (rpm)	87

# 03 Major Product (Hard Pad) Portfolio

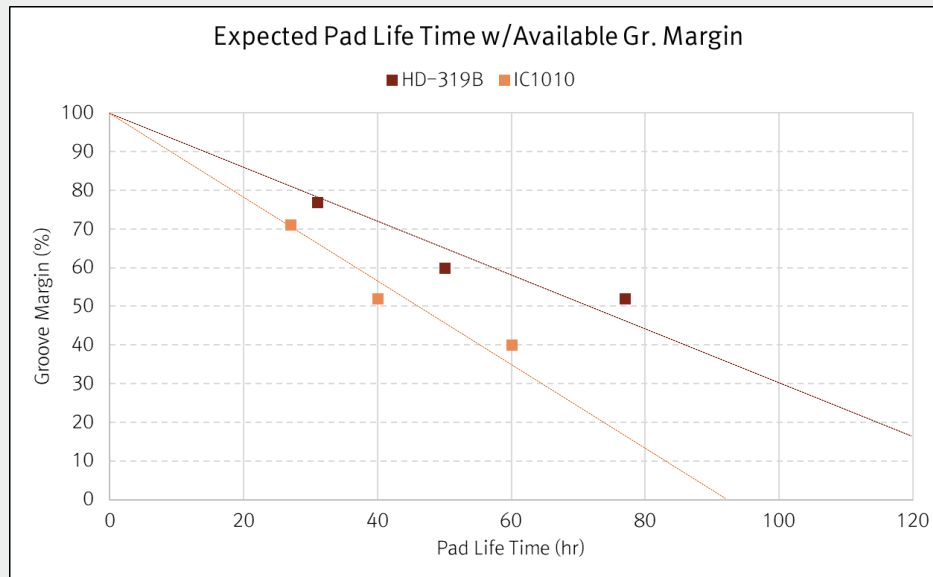
## Hard Pad\_HD-319B & HD-500C: Longer Pad Lifetime

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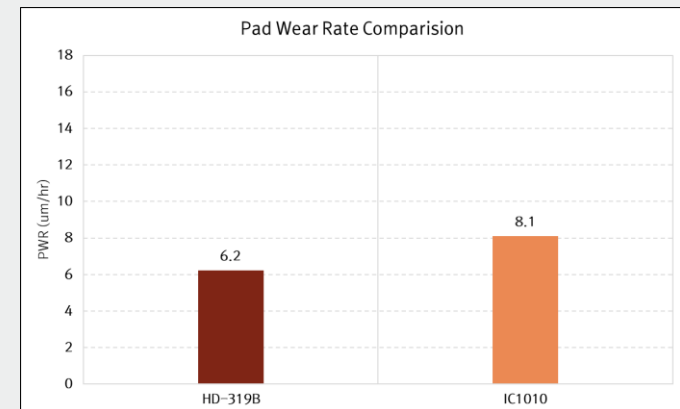
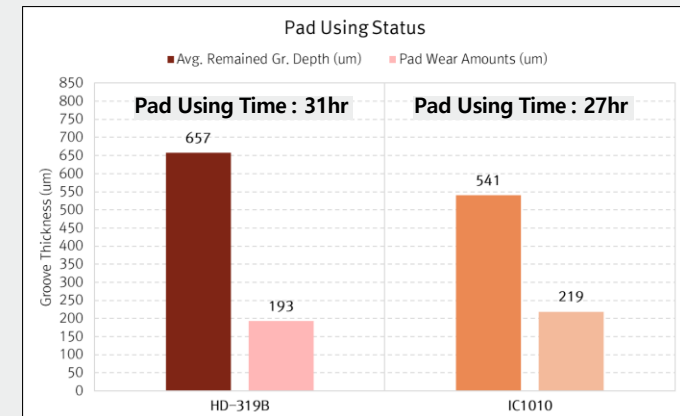
### ◆ 极思新材料HD-319B Pad

- CMP Application : Cu Bulk CMP
- **Lower pad wear rate**(PWR) compared to IC1010 in the same process conditions

Confirmed by the used pad up to the available pad lifetime in MFG Fab. line



- Different pad lifetime depending on the applied process conditions
- Used for Cu bulk CMP application in MFG customer's site up to **120hrs** in pad using time



# 03 Major Product (Hard Pad) Portfolio

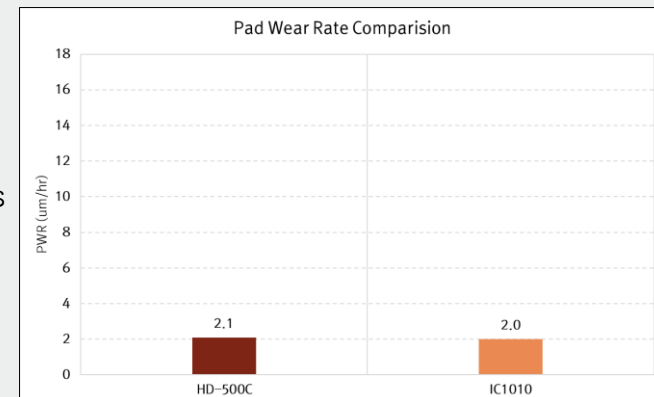
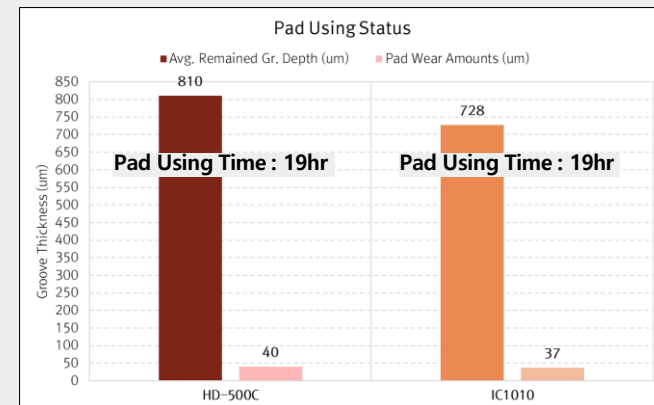
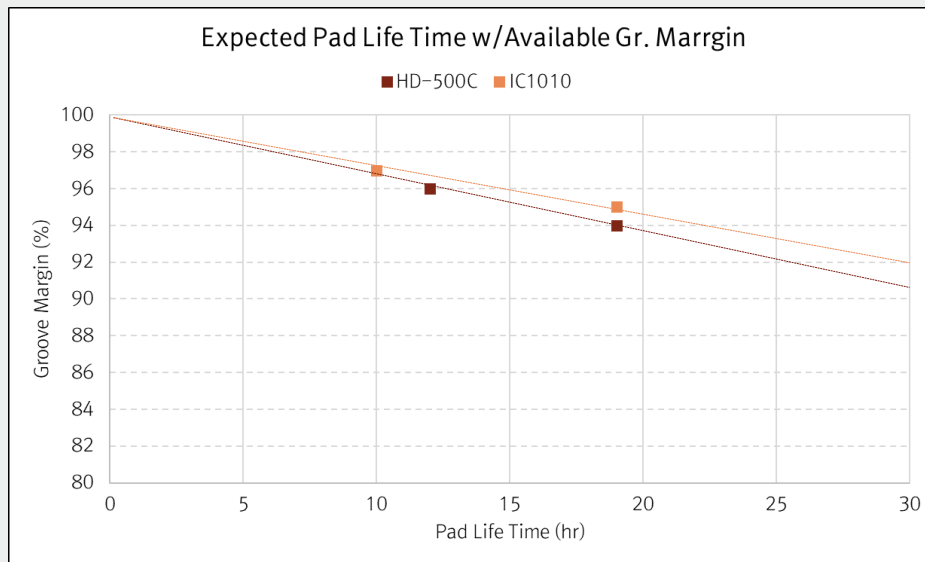
## Hard Pad\_HD-319B & HD-500C: Longer Pad Lifetime

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### ◆ 极思新材料HD-500C Pad

- CMP Application : Oxide CMP (ILD3)
- Comparable pad wear rate(PWR) to IC1010 in the same process conditions

Confirmed by the used pad up to the available pad lifetime in MFG Fab. line



- **Different** pad lifetime depending on the applied process conditions
- Used for Oxide CMP application in MFG customer's site up to **24hrs** in pad using time

**Lower defectivity** than IC1010 with the same pad using time



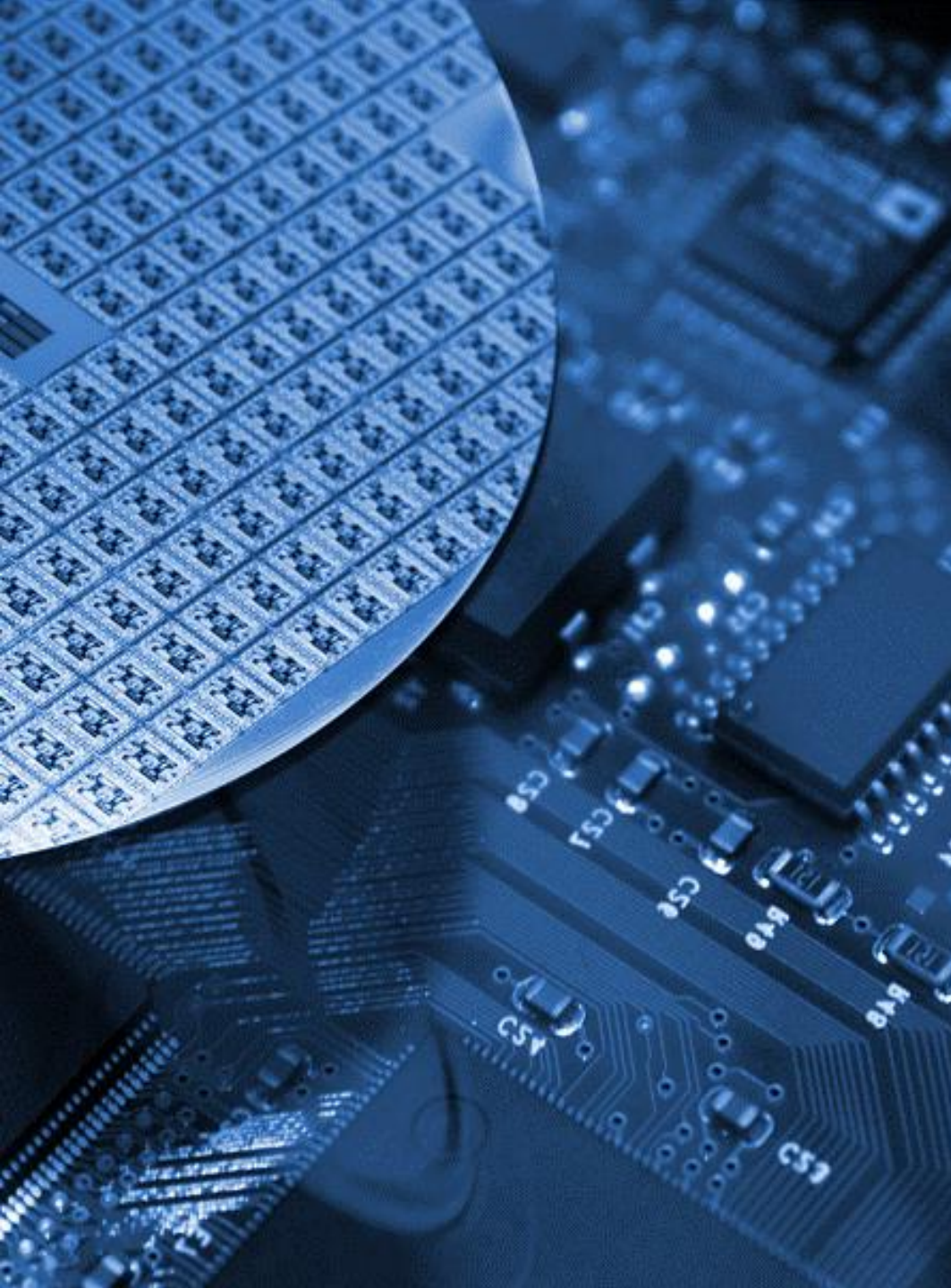
### ◆ 极思新材料Hard Pad Products

- Proposal pad against IC1010 : **HD-319B and HD-500C**

CMP Performance	HD-319B	HD-500C
Removal Rate	Comparable	Comparable
Defectivity	Comparable	<b>Better</b>
Pad Wear Rate	<b>Lower</b>	Comparable
Pad Lifetime	<b>Longer</b>	Comparable

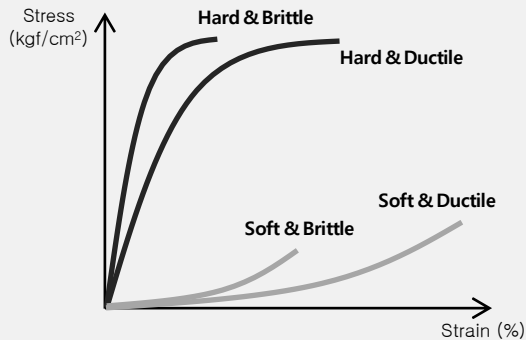
# 03

## Advantages of CMP Pad



### Why 极思新材料 CMP Pad?

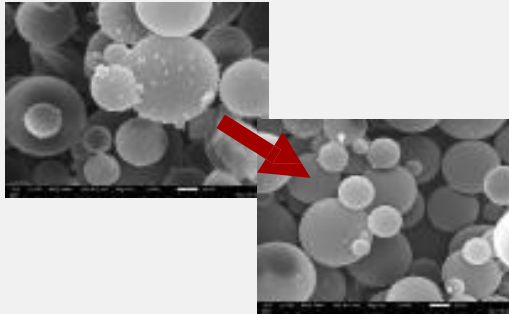
#### Material Composition



##### Raw material Self-Design

- Synthesize own pre-polymer
- Fast response to customer request
- Easy to optimize

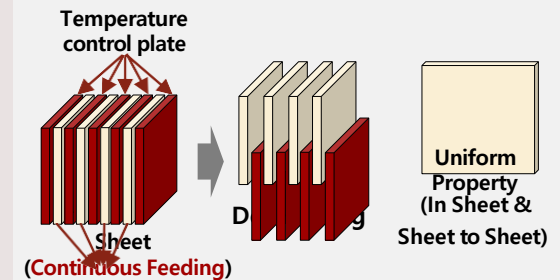
#### Pore Structure



##### Hybrid Pore System

- Solid microsphere and inert gas
- Various pore size implementation
- Contamination Controlled  
(Lower inorganic contamination)

#### Manufacturing Process



##### Single sheet casting

- Uniform Temp. control
- Uniform sheet material property  
(within Sheet & Sheet to Sheet)

**We can make more uniform with less defect/Scratch CMP pad**  
**We can quickly develop and deliver customized pad customers want**





# THANK YOU

极思新材料科技（无锡）有限公司

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