

**ROOTS**  
M A T E R I A L S

# ABOUT COMPANY

ROOTS Materials was established by experienced and passionate engineers to serve as a foundation for our customers' success in the LED and semiconductor manufacturing industries



## Vision

| To be the global leader in innovative phosphor technologies, revolutionizing the LED industry with the highest quality PiG solutions

| To illuminate the world with cutting-edge phosphor in glass technology, setting new standards for excellence in the global market

| To drive the future of lighting technology by pioneering the most advanced and sustainable PiG solutions worldwide.

## Mission

| To deliver unparalleled PiG products through our unique manufacturing process, ensuring superior performance and customer satisfaction across the globe

| To innovate relentlessly, offering the best phosphor in glass solutions that meet the evolving needs of our global customers

| To provide high-quality, reliable, and efficient PiG solutions that empower our clients to excel in the competitive LED industry.

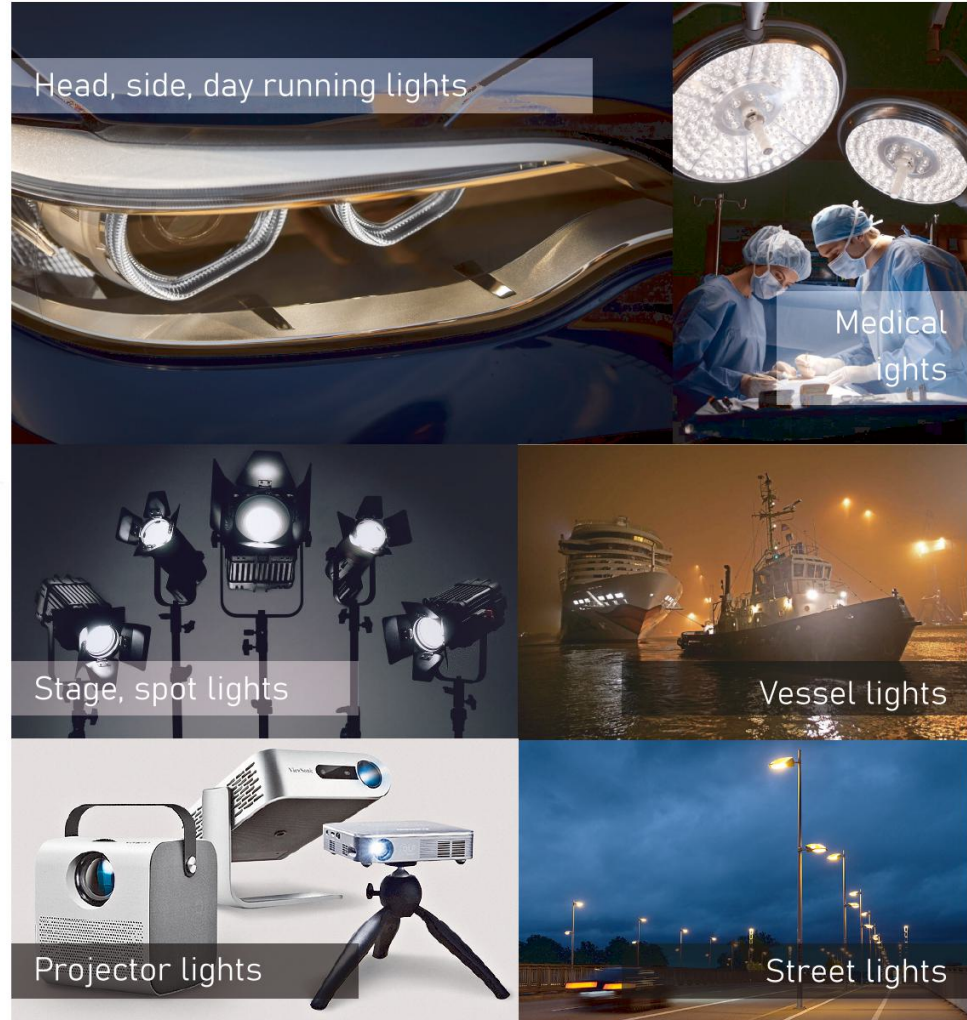
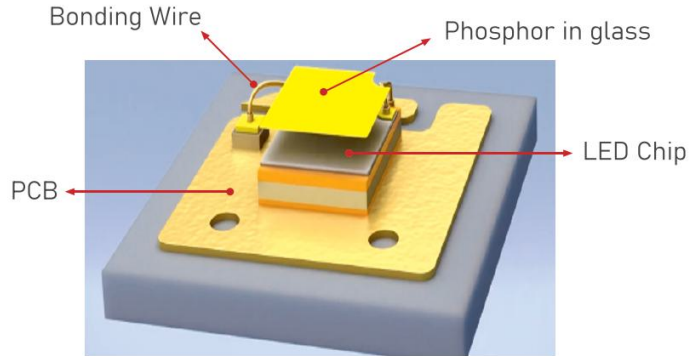
# History



2018.01	Established ROOTS CO., LTD.
2020.01	Established R&D Center
2020.04	Certified as a Venture Company
2021.03	Certified as a specialized in Materials, Parts, and Equipment company
2021.06	Certified with IATF 16949 and ISO 14001
2022.04	Recognized as an IP Global Star Company
2022.06	Certified as a Technology Innovationventure company (INNO-BIZ)
2022.09	NET New Technology Certification
2023.06	Certified as a Root Technology Company

# PIG PHOSPHOR IN GLASS

Our PiG (Phosphor in Glass) products, which we develop and manufacture, are designed for **high-power, high-reliability** lighting applications such as automotive headlights, medical lights, projectors, etc.. Unlike liquid silicone-based phosphors like PiS (Phosphor in Silicone), which are used in medium and low-power applications such as general lighting, our PiG technology is optimized for these more demanding environments.



## Suitable Applications

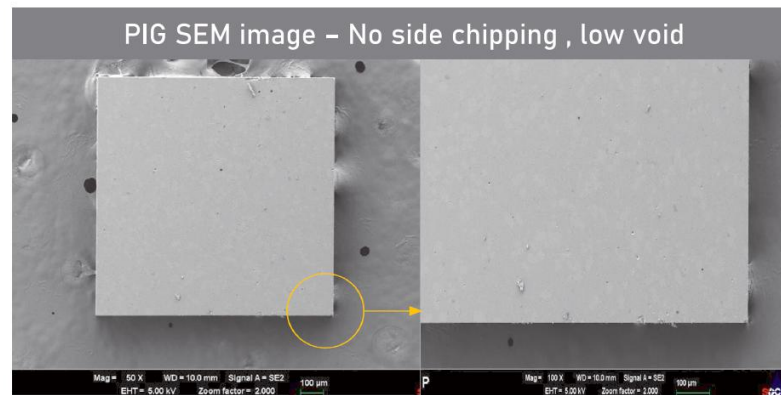
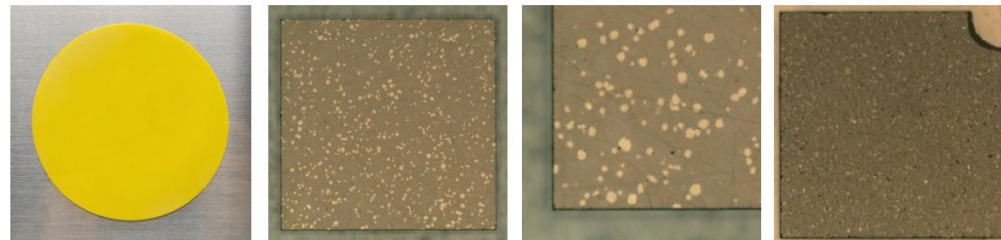
- Automobile Exterior
- High reliability products
- VOCs free products




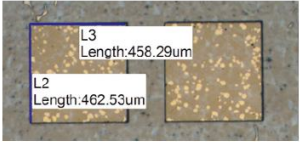


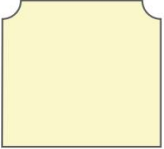
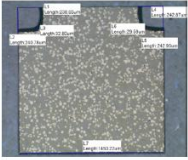
PRECISE DIMENSION CONTROL  
100% CHIP QUALITY INSEPCION  
100% COLOR INSPECTION  
NO CHIPPING ON SURFACE EDGE

Supporting white, amber color Supporting both vertical and flip chip type  
Offering size, thickness customization service R&D development support for new product

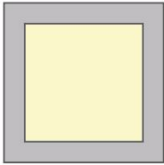


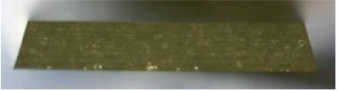


ALL IN-HOUSE PROCESS		
<b>WAFER FABRICATION</b> GLASS, PHOSPHOR MIXING 1st/2nd SINTERING	<b>CHIP FABRICATION</b> WAFER GRIDNING WAFER POLISHING DICING SORTING (BINNING)	<b>QUALITY INSPECTION</b> AUTOMATED VISUAL INSPECTION TARGET COLOR INSPECTION 100% CHIP INSPECTION



We possess proprietary technology for the production of PiG (Phosphor in Glass). Based on this, we are capable of developing and manufacturing ultra-small and ultra-thin PiG. Additionally, we can produce PiG in various forms. We are open to collaborating with customers on new development projects that lead the market

Small (Min. $450\mu\text{m}$ )		
Thin (Min. $50\mu\text{m}$ )		
Out cut edges		

ROOTS proprietary PiG processing technology offers a variety of structures suitable for enhancing optical properties.

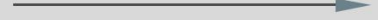
Reflection edge		
Angle-cut		
Various shapes		



# CHEMICAL SOLUTIONS



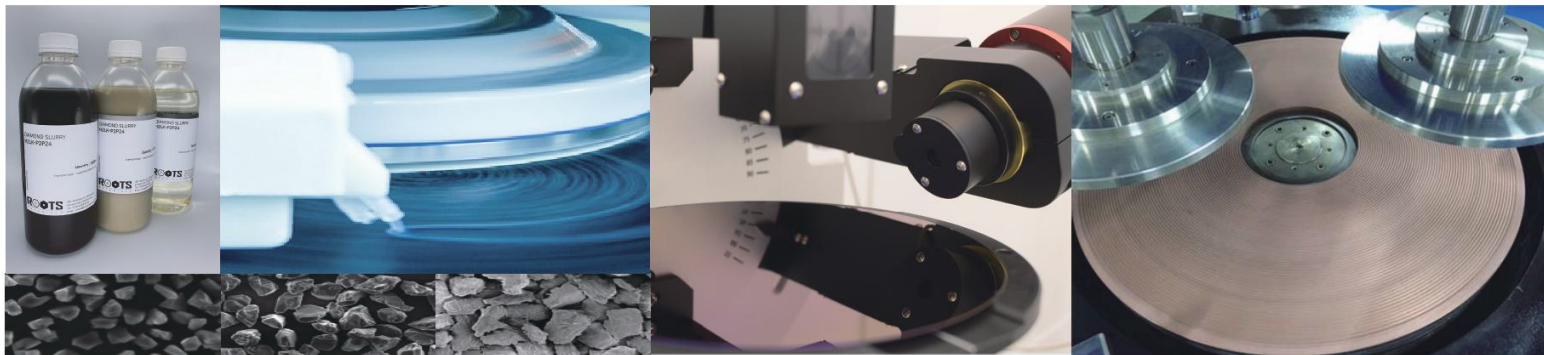
We develop and provide the most efficiently  
customized oil and water base diamond slurries



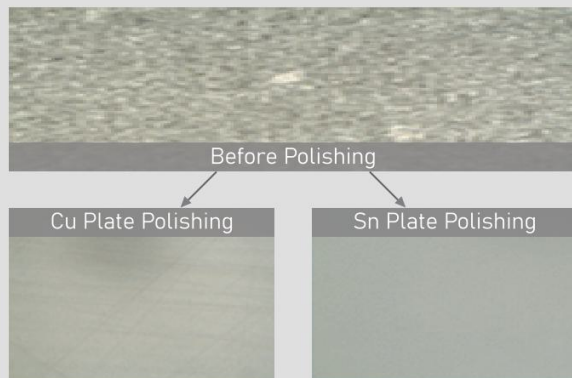
# OIL/WATER BASE DIAMOND SLURRIES

DIAMOND TYPE : MONO, POLY, BLAST  
POSSIBLE SIZE : 1.0 - 20 $\mu$ m

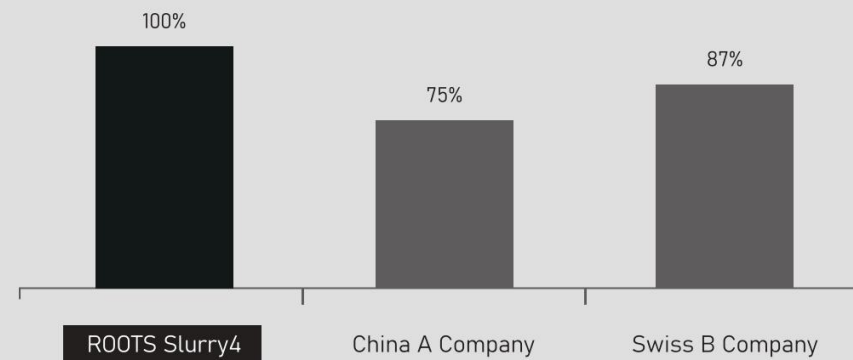
POLISHING FOR SAPPHIRE WAFER AND CERAMIC BASE PARTS  
VISCOSTY, DIAMOND DISTRIBUTION RATE CONTROL  
OFFERING ANY CUMSTOMIZED PRODUCTS



Wafve Backside Condition Before/After Polishing



Diamond Slurry  
Polishing Removal Rate Comparison



# Flux Cleaning Solution

pH Neutral cleaner based on Water soluble

Application for all kinds of cleaning methods ( Inline & Batch Type, Spray )

Perfect cleaning for flux residue

Anti Corrosion & High compatibility for sensitive Metals

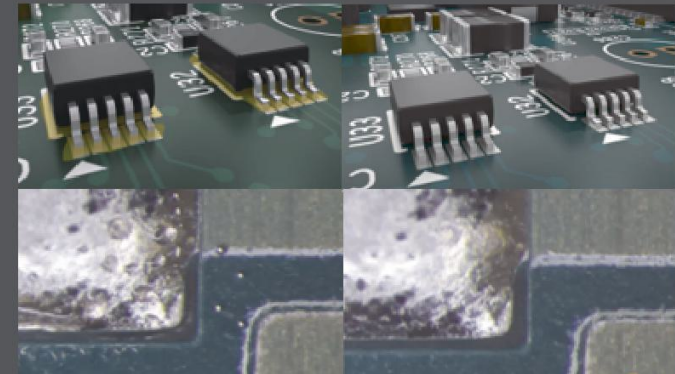
- Aluminum, Copper, Nickel, Plastic & Inks

Application & Merit

- LED Module, Power Module, Flip Chip & PKG

- Improve wire bondability and Soldering quality

- Improve encapsulation quality of Power components and soldering



Before

After

Specific Gravity	(g/ccm) at 20°C/68°F	0.96
Surface tension	(mN/m) at 25°C/77°F	29.1
Boiling point	°C/°F	98 - 229°C / 208 - 444°F
Flash point	°C/°F	None until boiling
pH	10g/l H2O	7.02
Vapor pressure	(mbar) at 20°C/68°F	약 20
Cleaning Temp.	°C/°F	40 - 70°C / 104 - 158°F
Solubility	-	Yes
Concentration for inline spray	Concentration	7.5 - 20 %
Concentration for Batch	Concentration	10 - 25 %
HMIS Grade	Health risk - Flammability - Reactivity	0 - 0 - 0

# Solder Mask Cleaner

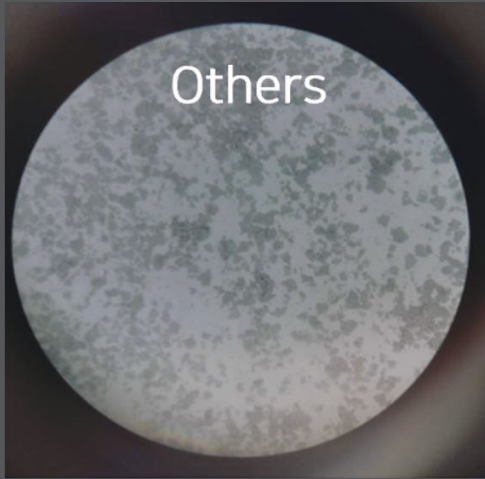
Eco-Friendly Cleaner

- Heavy metal / Halogen ( Cl, F, Br .. ) / VOC regulated substances “ Free “
- No Rohs / Environmental issues due to environmentally friendly materials
- Low evaporation rate

Solvent	Evaporation Rate
DI water	0.36
RMC-001	0.65
IPA	2.5

## Material Property

Solvent	Evaporation Rate
Appearance	0.36
Density	0.45
pH	0.65
Flash point	None
Oduor	Mild ether like
Storage condition	Room Temp (5~30°C)
Guarantee	1year with closed containers

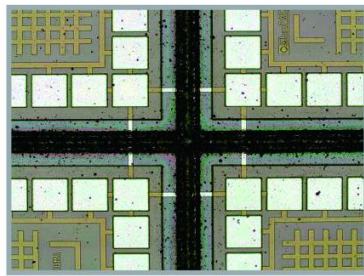


# LASER DICING COATING SOLUTION

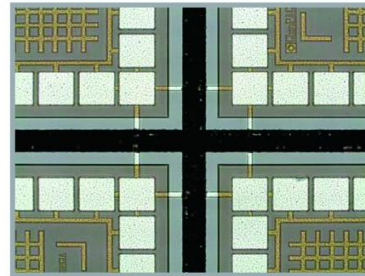
Part Number : RLC-B01, RLC-B02

Coating solution for protecting wafer from particles & thermal damage during laser dicing process

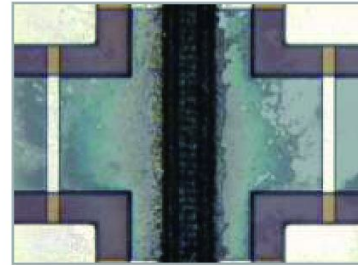
- Water soluble material
- Spin coating before laser process
- Cleaning with D.I water
- Stable coating layer
- No Debris , HAZ after laser process



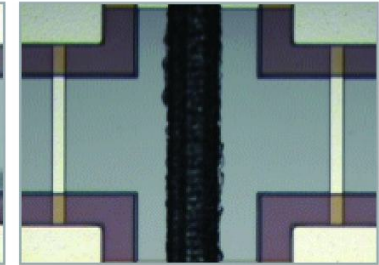
Before Cleaning



After Cleaning



Without Coating



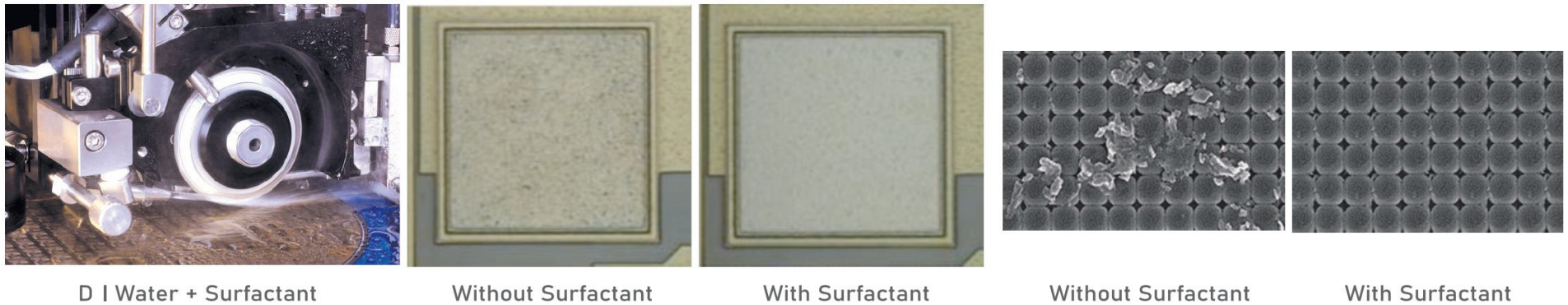
With Coating

ITEM	Specification		Remarks
	RLC-801	RLC-802	
Main component	Polyvinyl pyrrolidone (PVP)	Polyvinyl pyrrolidone (PVP)	
Appearance	Clear or Slightly yellowish	Clear or Slightly yellowish	Visual test
pH(at 20 °C)	3.0~5.0	3.0~5.0	pH meter (Orion Star A211)
Specific Gravity (at 20 °C)	1.01~1.03	1.01~1.03	Hydrometer Fisher Scientific
Viscosity (cps at 25 °C)	220~260	260~300	Remark) <sup>1</sup>

■ Remark)<sup>1</sup> Brookfield Viscometer (DV- II +Pro, Spindle No.62, 120rpm)

# SURFACTANT

Protect wafer from corrosion and particle contamination  
 Reducing chipping and crack, improving blade life time  
 Low consumption by dilution

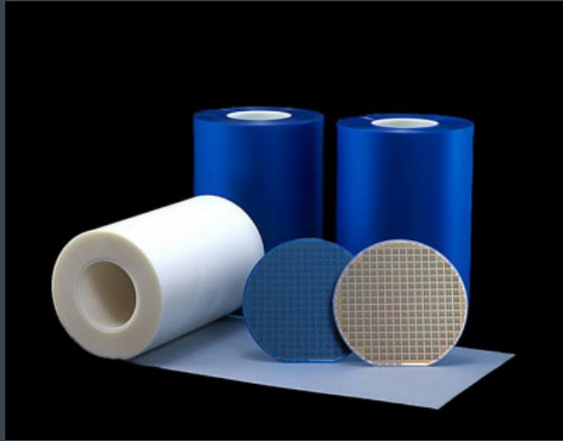


- Protect wafer from corrosion and particle contaminations by coating wafer surface
- Provide low frictional force by high lubrication property :  
 Reduced chipping & crack / Improved blade life-time
- Prevent static charge by controlling D-I water resistance
- Reduce pad corrosion and galvanic cell
- Comparatively low consumption by dilution

Item	Description
Main Ingredient	Nonionic Surfactant
pH (at 20°C)	5~6
Specific Gravity (at 20°C)	1.02~1.03

# Tapes

## Distribution



### UV Tape (H-Series)

- Easy detachment after UV radiation
- Tape Material : PO, PET (Thickness and adhesion can be customized)

### Non-UV Tape (L-Series)

- High expansion and low adhesion / Suitable for chip temporary fix

### Thermal Release Tape (K-Series / Denka Counter Parts)

- Extremely thin grinding capability.
- Eliminates warping and sagging by firmly supporting the wafer.
- Easily releases at any time with heat treatment

# Wheels

## Distribution



### Silicone grinding wheel

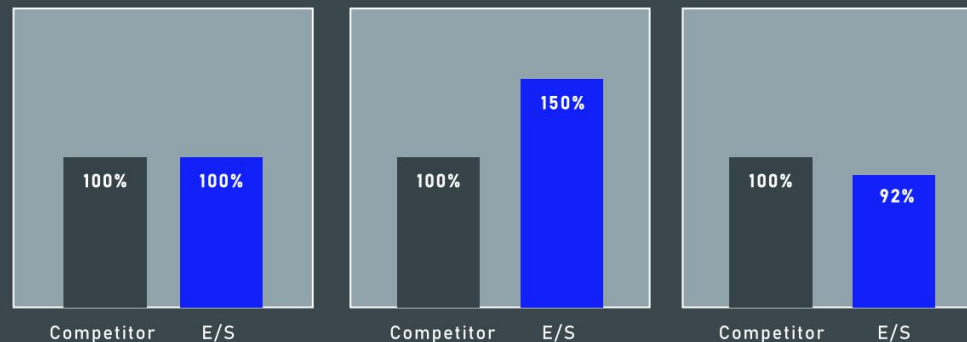
- Wafer surface roughness and die strength can be improved
- Grinding stress and wafer edge chipping can be reduced
- Diamond at the tip can be distributed consistently
- Possible to grind Si wafer up to 17um ( Ultra thin wafer )



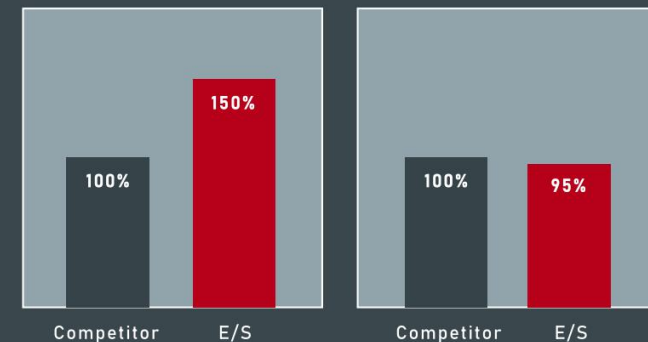
### Ceramic and Glass grinding wheel

- Leading technology in various types of machines and applications
- Rough wheel ( Metal bond ) : Long life time and excellent bulk removal rate
- Fine wheel ( Vitrified bond ) : Superior grinding ability and roughness
- Providing proper wheel designs for various grinding methods and proper recipes

Grinding wheel ( #270-MX ) Test results



Grinding wheel ( #400-MX ) Test results





# CONTACT

## Location

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WARM  
WHITE

DAY  
LIGHT

COOL  
WHITE

**ROOTS**  
MATERIALS