PRODUCT CATALOGUE · SEMICONDUCTOR

NANOPOL

Vitrified grinding wheels for silicon and compound wafers

Wheel line-up, technology, wheel specifications and test results for back-grinding and polishing of Si wafers, compound wafers and molded wafers. Grit range #400 to #30,000.

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SINCE 1975

The range at a glance

NANOPOL is EHWA's vitrified-bond wheel programme for wafer back-grinding. Two zones cover the process: a Z1 rough wheel removes stock, a Z2 fine and polishing wheel sets the final surface. Separate bond families exist for silicon wafers and for compound and molded wafers, where ductile materials such as EMC, polymer, copper and tin adhere to the tip surface.

GRIT RANGE	WAFER THICKNESS	ROUGHNESS RA	DAMAGE LAYER
#400–#30,000	to 17 µm	~1.3 nm	~49 nm

CONTENTS

NANOPOL wheels for 300 mm back-grinding.

Technology and line-up

TECHNOLOGY

- 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
- Porosity, pore shape and pore size control can be adjusted
- Possible to grind Si wafer up to 17 µm (ultra-thin wafer)

WHEEL LINE-UP · GRIT

#400 #600 #800 #1000 #2000 #3000 #4000 #5000 #6000 #8000 #10000 #20000 #30000

Z1 Rough

VSZT

Stock removal from #400 to #2000.

Z2 Fine & polishing level

VK8B · VKBT · VNP · VGP

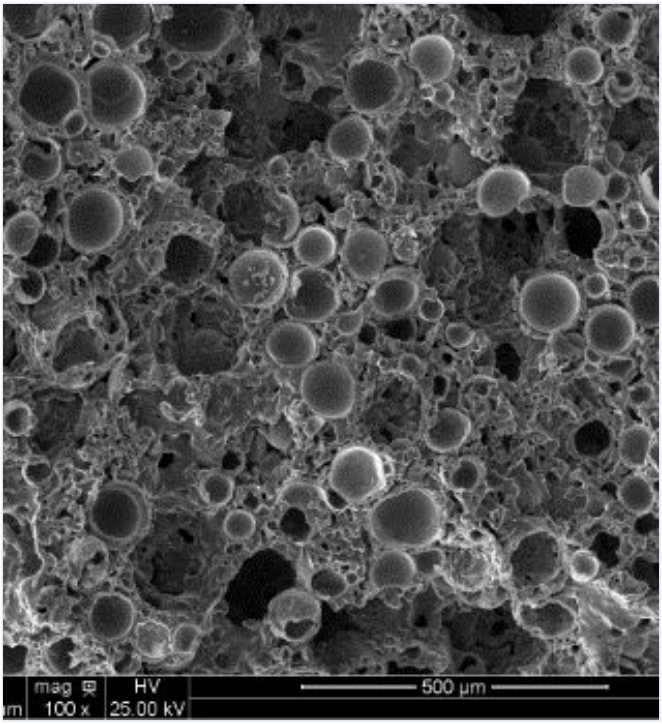
Fine grinding and polishing up to #30,000.

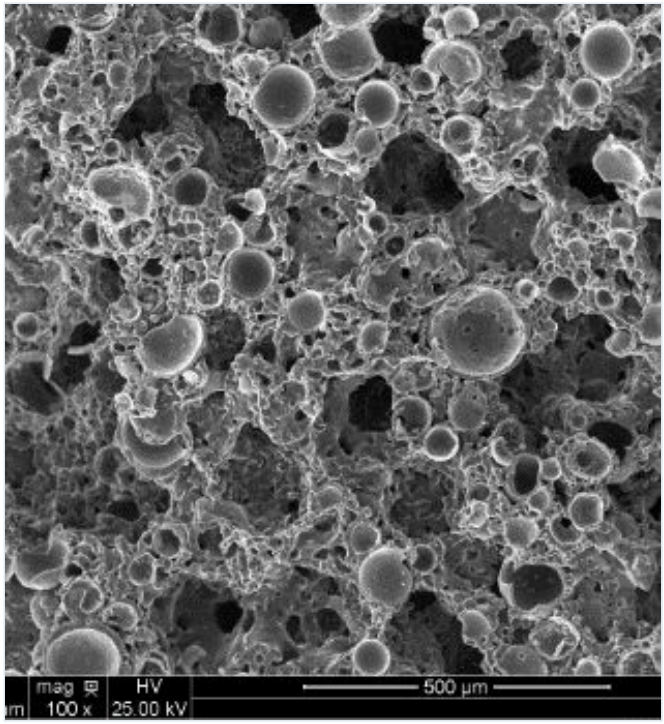
Z1 wheel specification and performance

Test machine DGP8761 · 300 mm Si wafer

WHEEL SPEC.	NP-D4-303D3.0W10X-800-VSZT	NP-D4-303D3.5W10X-600-VSZT
Grit size	#800 · Mean ~16 µm, Max ~41 µm	#600 · Mean ~20 µm, Max ~63 µm
Concentration	75	75
Porosity [vol.-%]	~75 %	~75 %
Bond	VSZT	VSZT
Recipe	Wheel / chuck RPM 2700 / 300 Feed [µm/s] 5–3–1	Wheel / chuck RPM 3200 / 300 Feed [µm/s] 5–3–1
Grinding current [A]	~13.0	~14.0
Wheel life [pcs]	15,000	12,000

SEM IMAGE ×100



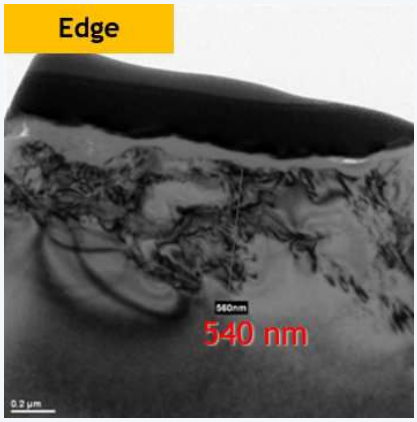


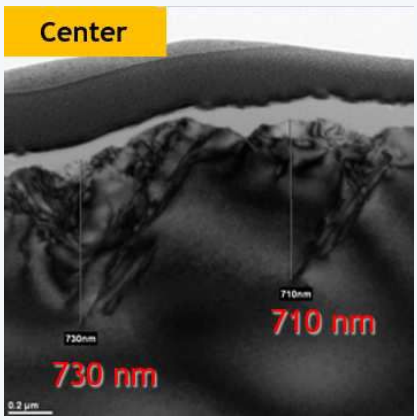
Si wafer surface damage layer after Z1 grinding

Resin #325 compared with vitrified #600 · TEM cross-section at wafer edge, middle and center

Resin #325

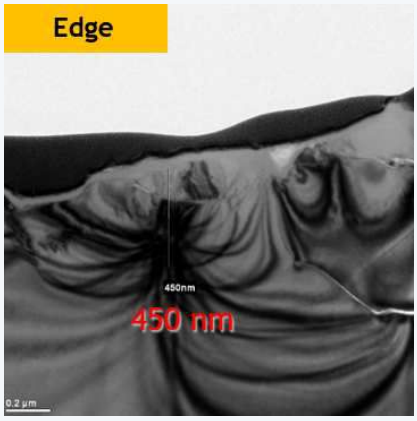
540 / 1000 / 730 nm

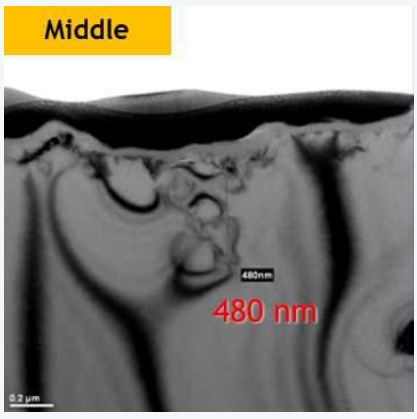


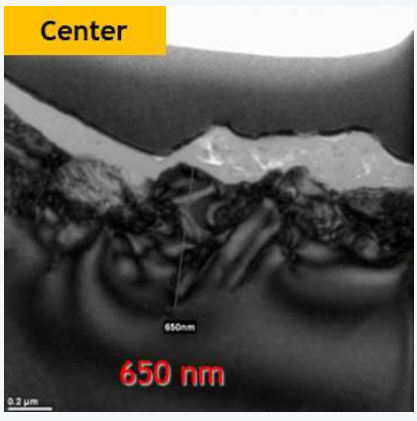


Vitrified #600

450 / 480 / 650 nm







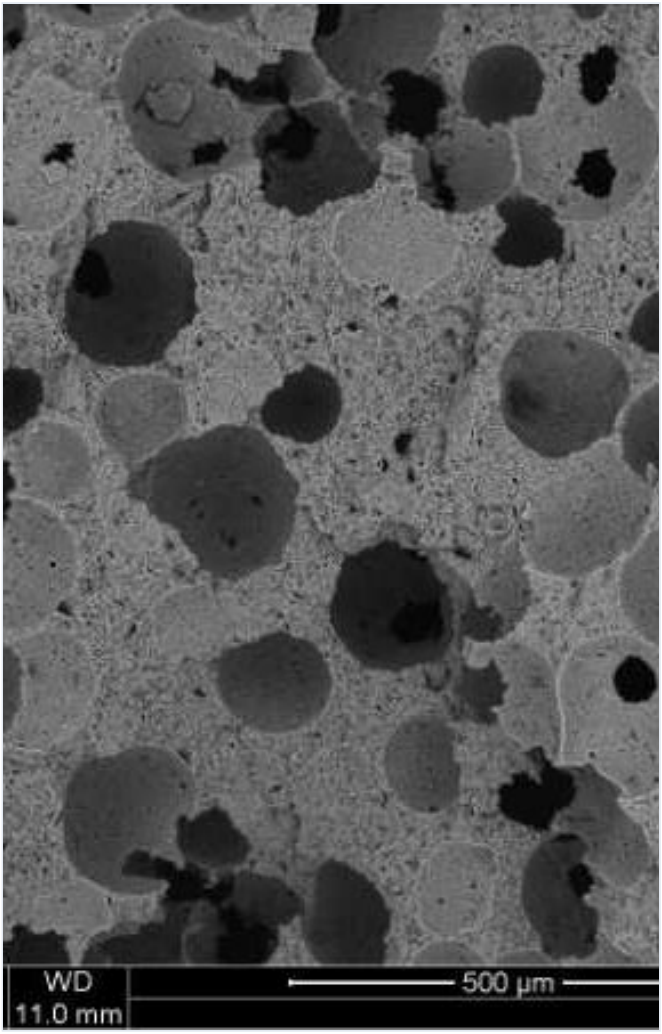
The vitrified wheel leaves a thinner and more uniform damage layer across the wafer than the resin-bonded reference, which directly supports die strength.

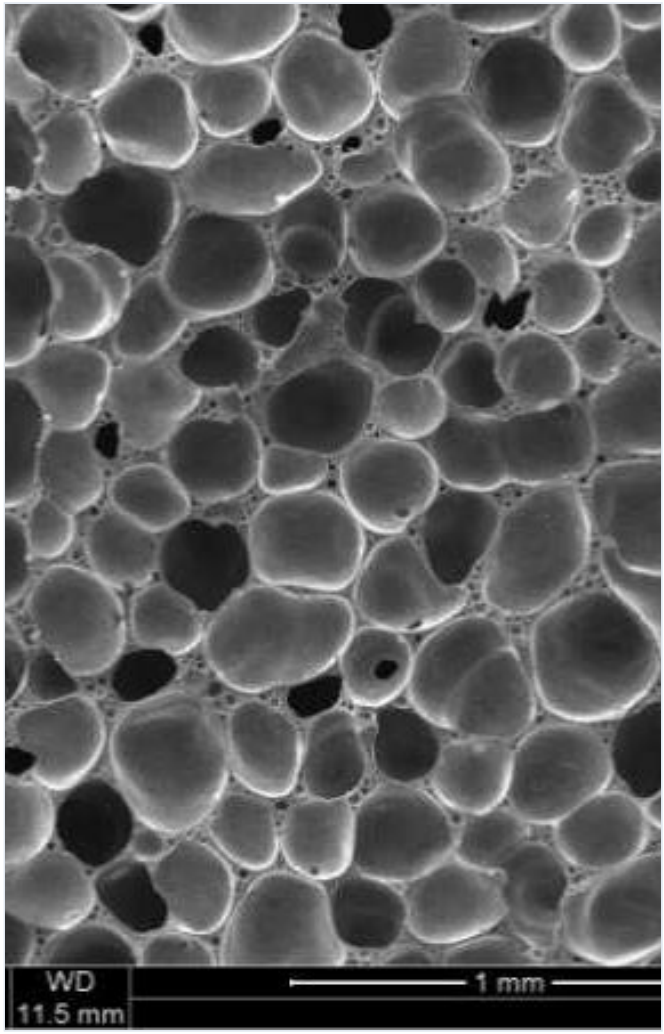
Z2 wheel specification and performance

Test machine DGP8761 · roughness measured with Wyko Veeco NT9100

WHEEL SPEC.	NP-D4-303D3.5W10X-5000-VKBT25	NP-D4-303D3.0W7X-8000M-VNPSSR
Grit size	#5000 · Mean ~2.0 µm, Max ≤ 5.5 µm	#8000 · Mean ~0.55 µm, Max ≤ 1.2 µm
Grinding current [A]	13.5 A at feed 0.6 µm/s	15.5 A at feed 0.2 µm/s
Roughness	Ra ~4.8 nm · Rmax ~56 nm	Ra ~1.3 nm · Rmax ~15 nm
Wheel life [pcs]	23,000	4,500

SEM IMAGE ×100



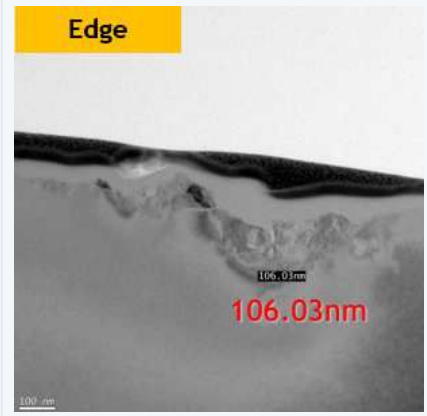


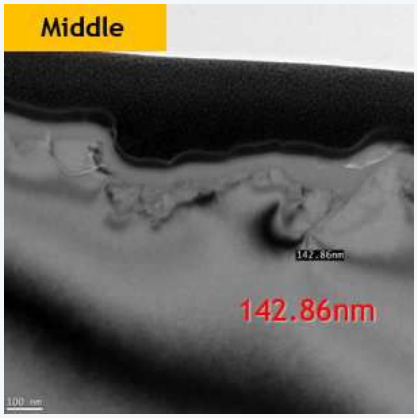
Si wafer surface damage layer after Z2 grinding

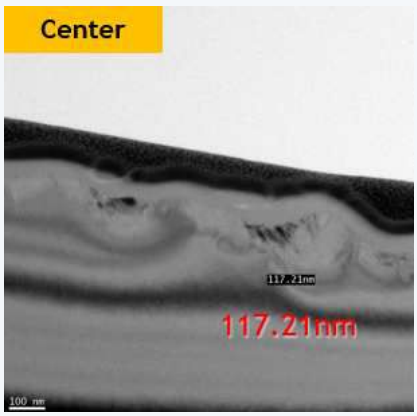
Vitrified #5,000 compared with vitrified #8,000 · TEM cross-section at wafer edge, middle and center

Vitrified #5,000

106 / 143 / 117 nm

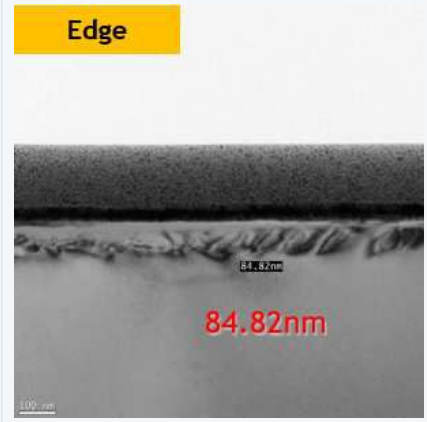


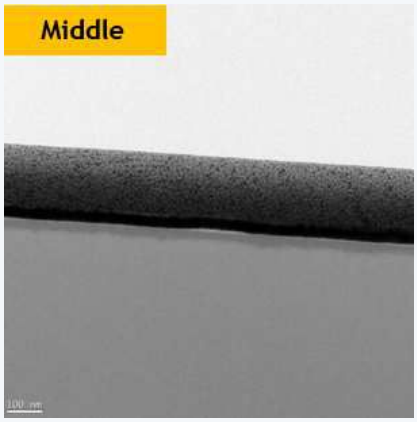


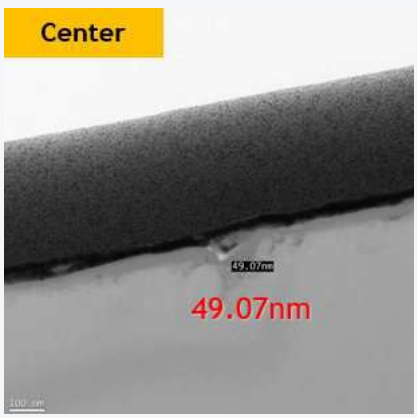


Vitrified #8,000

85 / 85 / 49 nm





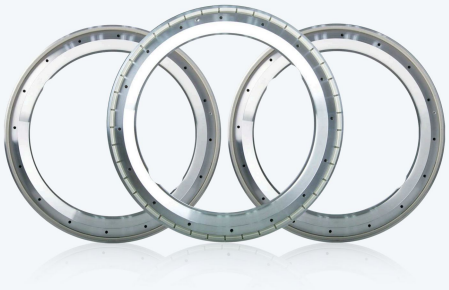


At #8,000 the damage layer drops below 100 nm, with a center value of 49 nm — the basis for ultra-thin wafer processing down to 17 µm.

Technology and line-up

TECHNOLOGY

- 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
- Porosity, pore shape and pore size control can be adjusted
- Possible to grind Si wafer up to 17 µm (ultra-thin wafer)
- Outstanding grinding ability for TSV and normal (for fingerprint) compound wafer



WHEEL LINE-UP · GRIT

#400 #600 #800 #1000 #2000 #3000 #4000 #5000 #6000

Z1 Rough

VSP series · VSBT series

Soft bond and reduced bond content for ductile layers.

Z2 Fine & polishing level

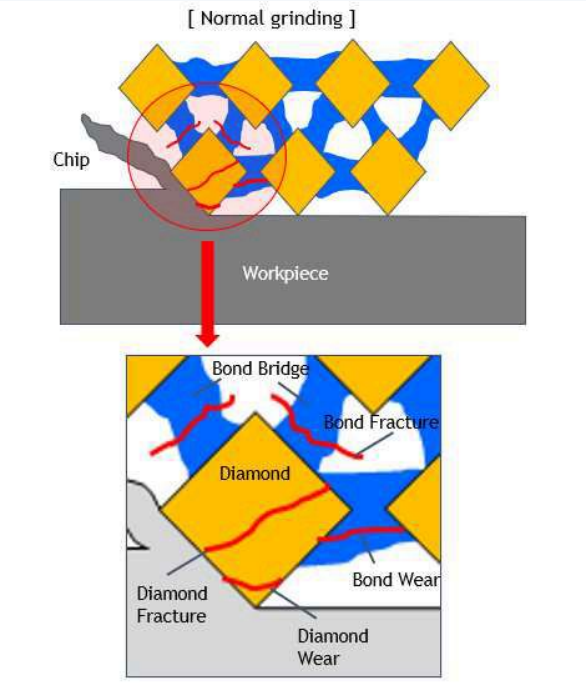
VSPS series · VK8HS · VK8B

Fine grinding of compound, Cu via, polyimide and solder.

Grinding mechanism

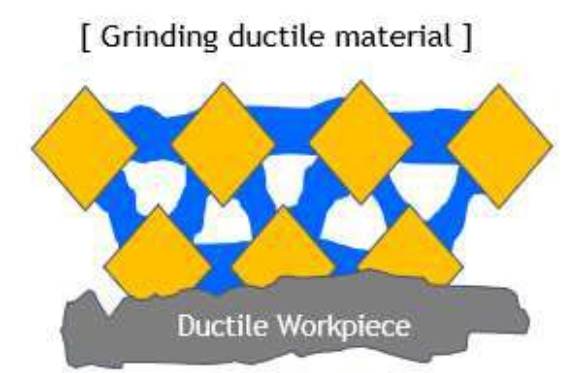
Normal grinding (e.g. Si wafer) compared with ductile material grinding (e.g. compound or molded wafer)

Normal grinding



As processing progresses, diamond wear and fracture occur, bond wear happens, and new diamond inside the wheel is released, allowing for continuous smooth processing.

Ductile material grinding

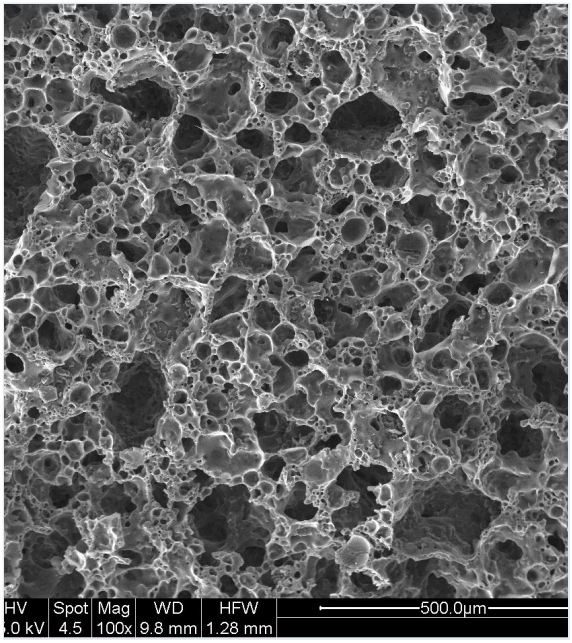
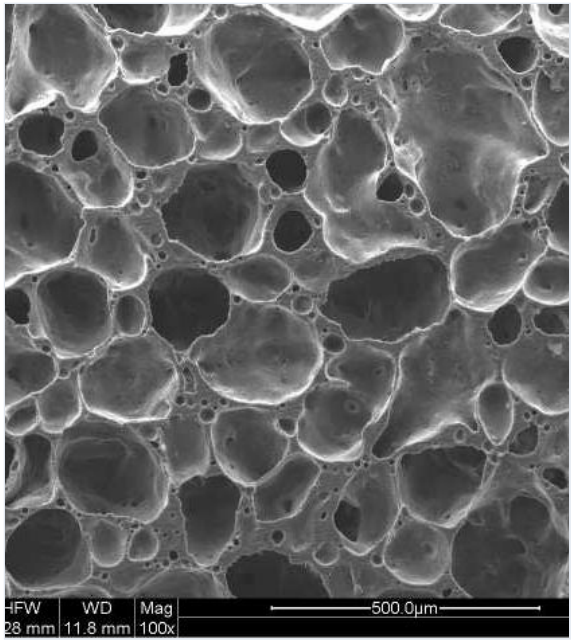
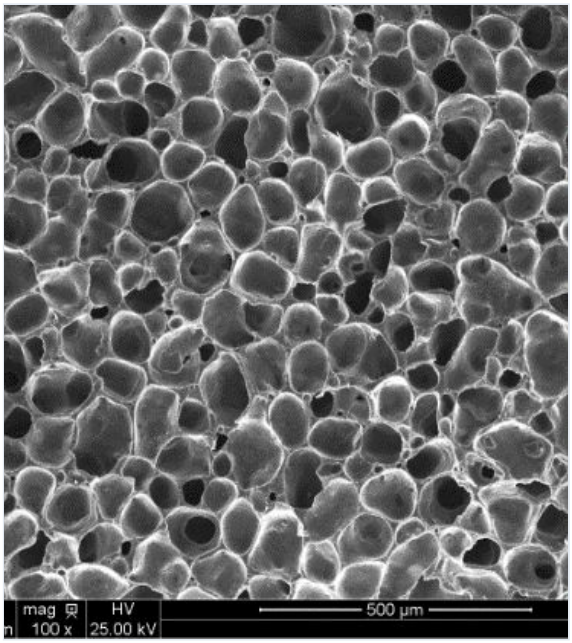
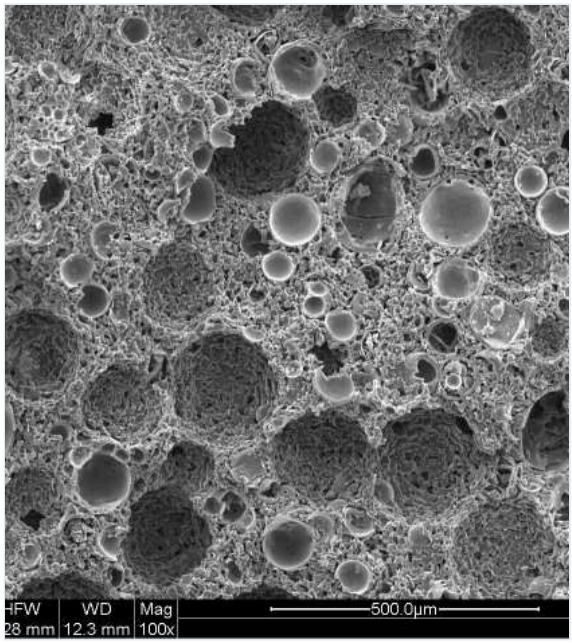


In the case of ductile materials, diamond wear, diamond fracture, bond wear and bond fracture do not occur due to their low hardness. As a result, normal processing is not carried out, and the workpiece gets stuck on the wheel surface.

> By lowering the bond hardness and reducing the bond content, the thickness of the bond bridge is reduced. This increases wheel wear as much as possible, allowing soft materials attached to the surface to be removed quickly.

Wheel structure: Si wafer wheel vs. compound wafer wheel

SEM comparison of rough and fine wheel structures

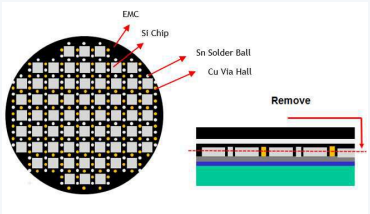
	Wheel for grinding compound wafer	Wheel for grinding Si wafer
ROUGH WHEEL		
FINE WHEEL		

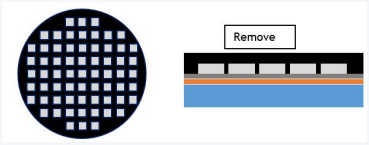
Compound wafer wheels run a coarser, more open pore structure with thinner bond bridges, so material adhering to the tip is cleared as the bond wears.

Compound wafer structure and wheel specification

Recommended zone specification by wafer build-up

WAFER STRUCTURE	WHEEL SPECIFICATION
Compound (e.g. EMC)	#325 ~ #2000 VSP3 · #325 ~ #2000 VSP5
Compound + silicon chip	Z1 #400 VSP3 + Z2 #4000 ~ #5500 VK8HS
Compound + silicon chip + copper via	Z1 #800 VSP3 + #3000 VK8HS4 · Z1 #800 VSP3 + #4000 VSPS10
Compound + silicon chip + copper via + polyimide + solder	Specification on request

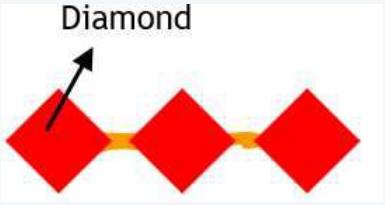




Wheel concept for compound wafer grinding

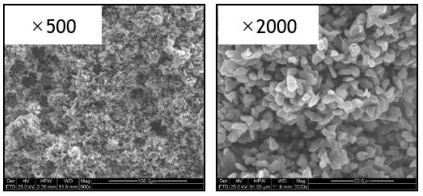
Ductile materials such as EMC, polymer, Cu and Sn have a high tendency to adhere to the tip surface. Two methods can be used to develop a wheel for grinding ductile materials properly.

METHOD 1 · BOND BRIDGE



Bridge is thin so it can be worn or broken easily.

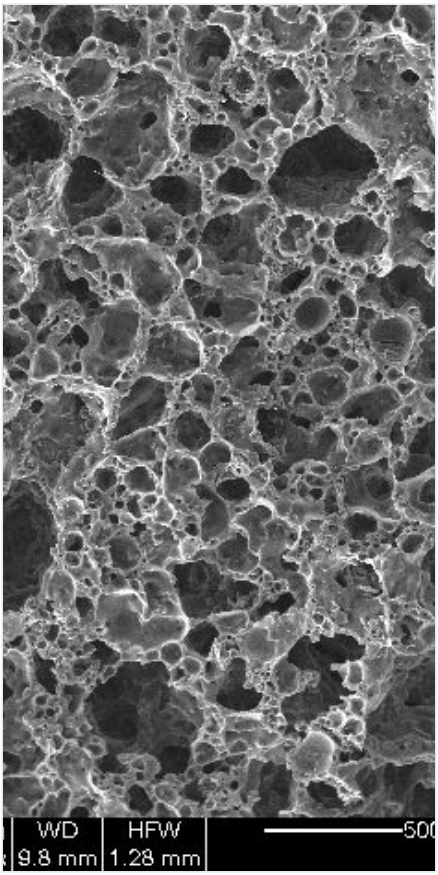
METHOD 2 · MICRO STRUCTURE



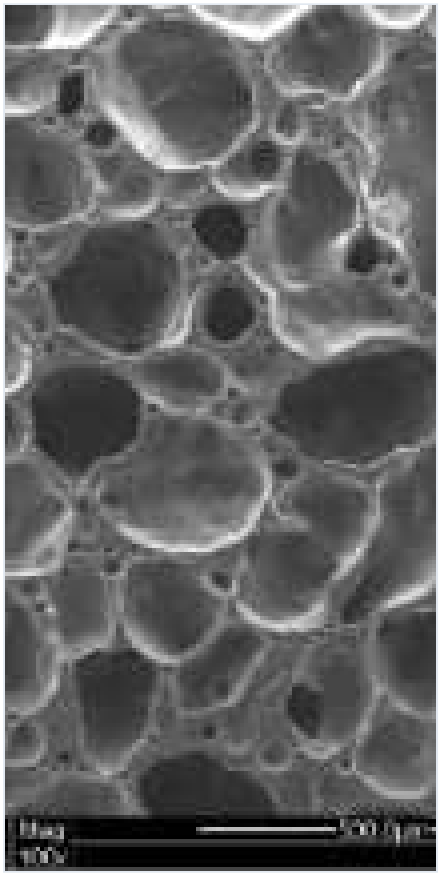
#3000 VSPS10 · micro structure at ×500 and ×2000.

MICRO STRUCTURE BY SPECIFICATION · SEM ×100

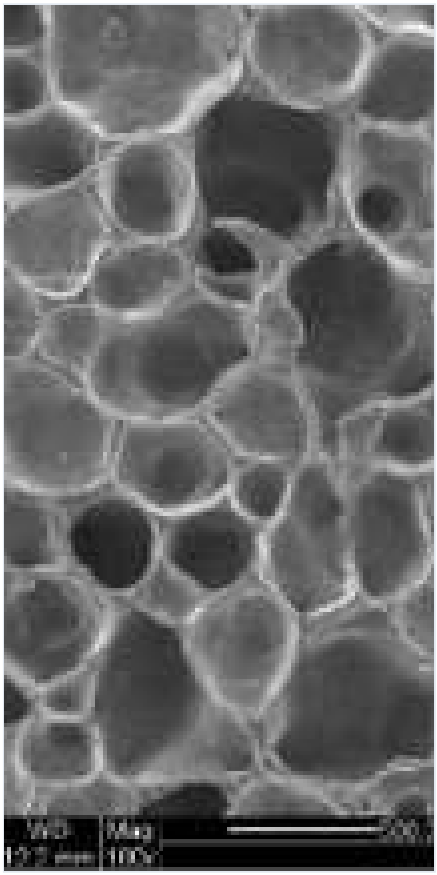
#800 VSP3



#4000 VK8HS



#5000 VK8HS



Talk to a process engineer

Wheel specifications are selected against the wafer build-up, the machine and the target surface. Send the wafer structure, machine type, target thickness and surface requirement, and you will receive a wheel proposal with a test recommendation.

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INFORMATION REQUIRED FOR A QUOTATION

- Wafer structure and materials
- Target thickness and removal per zone
- Current wheel specification in use
- Grinder type and wheel mount
- Required roughness and damage layer
- Annual quantity and delivery location

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