

Wafer polishing: DP, GDP and GPP

Dry polishing tools for silicon wafers with complete DP, GDP and GPP configurations, trial conditions, roughness measurements and TEM findings.



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Select the tool, surface and process together

Dry polishing and gettering polishing after back grinding

EHWA offers polishing tools for finishing silicon wafers after back grinding. DP is used for dry polishing; GDP and GPP extend the range with configurations for gettering polishing. The examples show mirror surfaces, low roughness and increased die strength after the polishing step. Tool configuration, protective tape, machine and required backside structure are selected together.

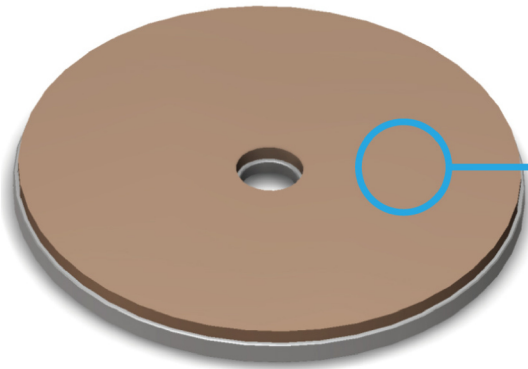
Range	Name	Illustrated application
DP	Dry Polishing Wheel	Dry polishing of silicon wafers; wool felt with ZrO_2 , specified as 250 nm
GDP	Gettering Dry Polishing Wheel / Pad	Gettering dry polishing; different tool and machine examples
GPP	Gettering Polishing Pad	Gettering polishing; trial on 12-inch silicon wafers using DISCO DGP8761

In dry polishing, the polishing abrasive is contained in the tool; the polishing step does not require a separate polishing slurry. The process can reduce grinding damage on the wafer backside and support mechanical strength. Gettering also requires a suitable backside structure where impurities can be trapped. Low roughness alone does not demonstrate this function. The DP, GDP and GPP configurations are therefore described with their respective process examples.

DP-350D: field trial and optical measurement

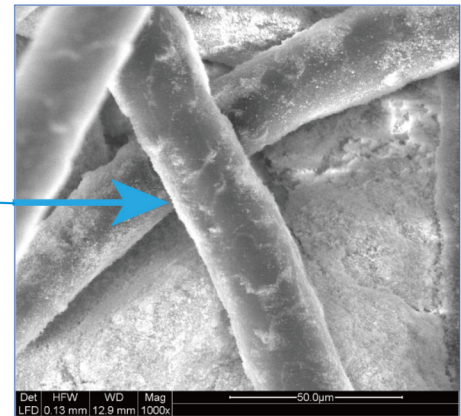
The DP configurations show wool felt with ZrO_2 (250 nm) for polishing silicon wafers. The process sequence uses EHWA back grinding wheels at Z1 and Z2, followed by EHWA DP-350D at Z3. Two DP documents contain this example at different image resolutions; the pictures from both versions are retained.

DP: wool felt and ZrO₂ (250 nm)



Polishing wheel

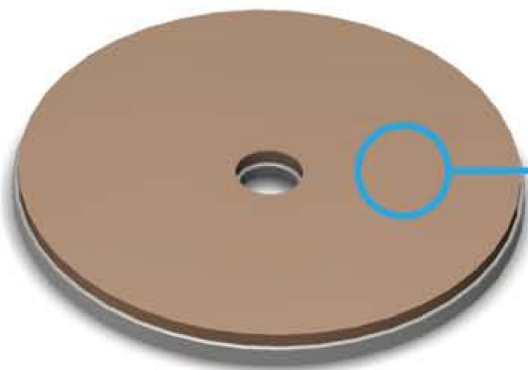
Schematic image relationship · Q004



Impregnated felt · SEM ×1000

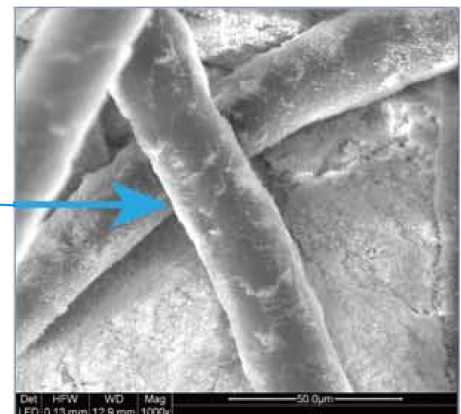
DP wheel and impregnated wool felt; SEM photograph with original 50 µm scale, Q004 version.

DP: wool felt and ZrO₂ (250 nm)



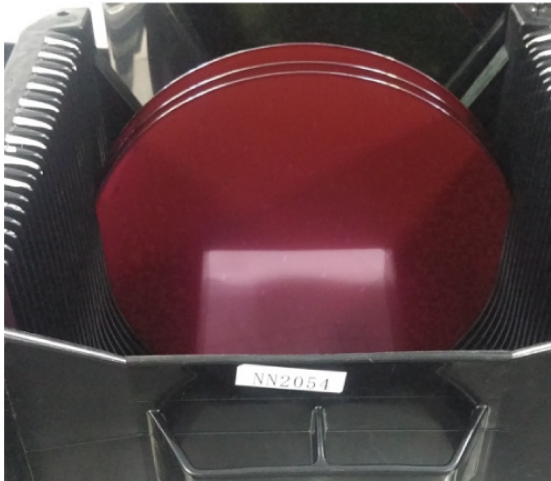
Polishing wheel

Schematic image relationship · Q019

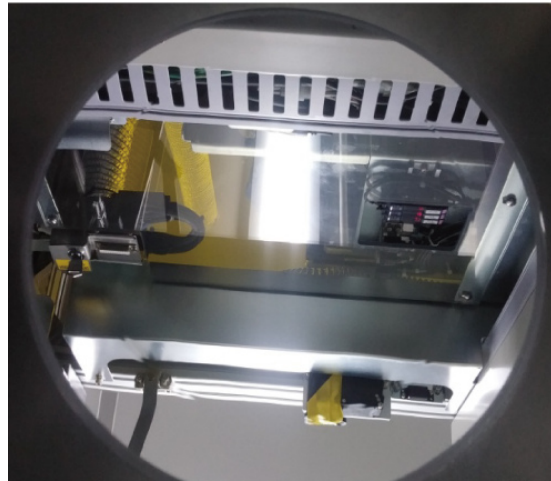


Impregnated felt · SEM ×1000

DP wheel and impregnated wool felt; SEM photograph with original 50 µm scale, Q019 version.



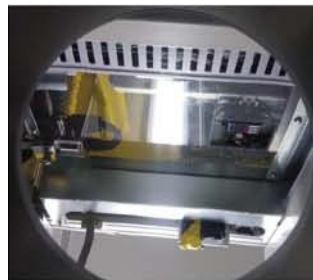
Silicon wafer in the DP-350D process example, Q004 version.



Processing equipment in the DP-350D example, Q004 version.

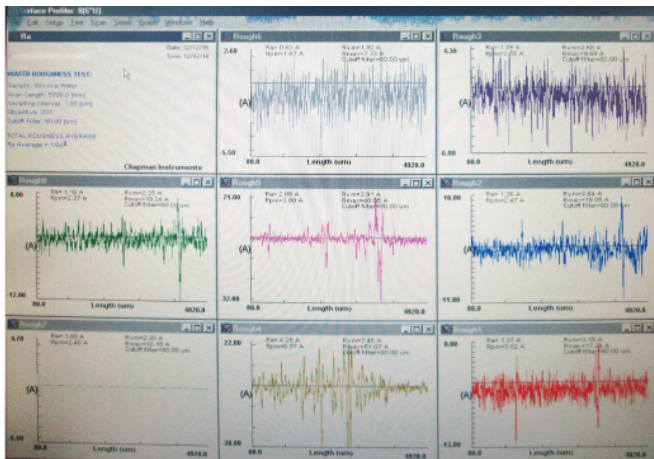


Silicon wafer in the DP-350D process example, Q019 version.



Processing equipment in the DP-350D example, Q019 version.

Field trial	Q004	Q019
Sampling interval	1.0 μm	1.0 μm
Objective	20×	20×
Cutoff filter	80.00 μm	80.00 μm
Measuring instrument	MP2000+	MP2000+
Average roughness, Ra Average	1.64 $\text{\AA}$	1.64 $\text{\AA}$

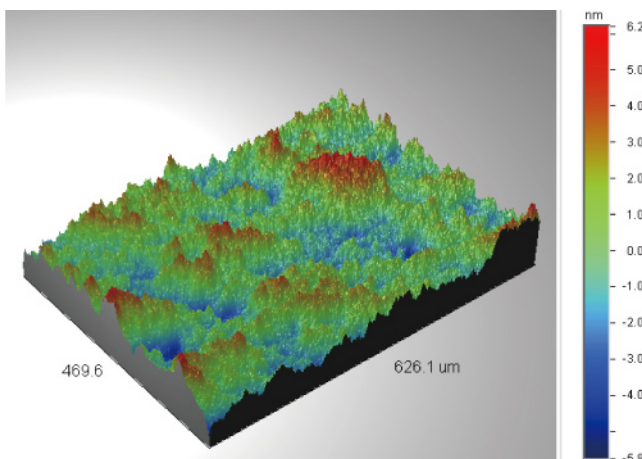


Original DP field measurement display from Q004, including the individual profiles.

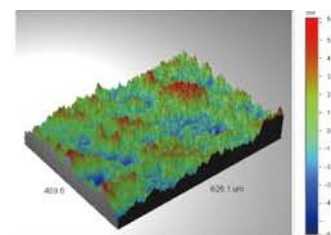


Original DP field measurement display from Q019, including the individual profiles.

Separate optical measurement	Q004 / Q019
Ra	1.17 nm
Rq	1.48 nm
Rt	11.97 nm
Measuring instrument	Wyko NT3300
Method	Optical 3D surface measurement



Optical 3D surface from Q004 with unchanged colour scale and spatial axes.



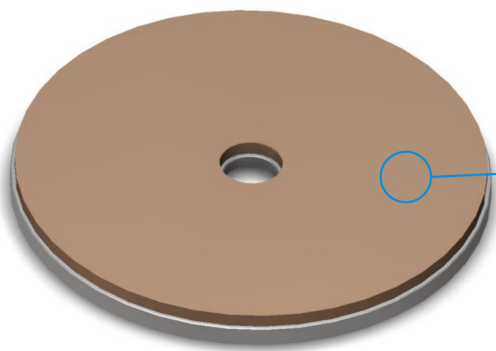
Optical 3D surface from Q019 with unchanged colour scale and spatial axes.

The results come from different measurement setups. The field trial value in Å and the optical measurement values in nm are presented separately.

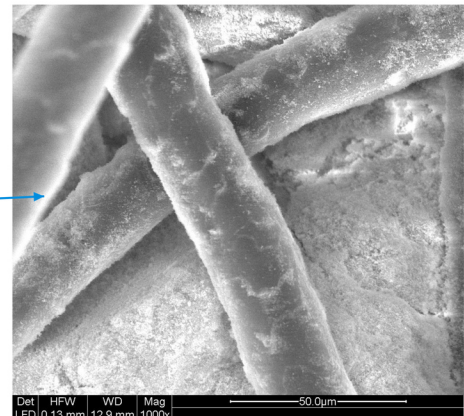
DP: wool felt and impregnation

The detailed DP presentation describes wool felt and ZrO_2 (250 nm). Before impregnation, the SEM photograph shows the felt fibres; after impregnation, the surface is labelled as resin with ZrO_2 . The embedded original scales are 50 μm in both photographs at $\times 1000$ magnification.

DP: wool felt and ZrO_2 (250 nm)



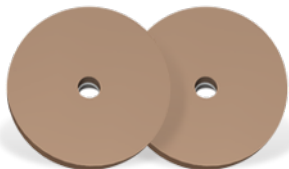
Polishing wheel



Impregnated felt · SEM $\times 1000$

Schematic image relationship · Q219

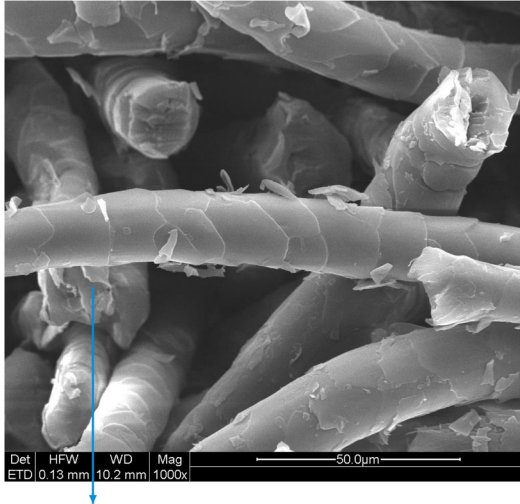
DP wheel and SEM structure of impregnated felt from Q219, page 1.



Two DP wheels illustrated in Q219.

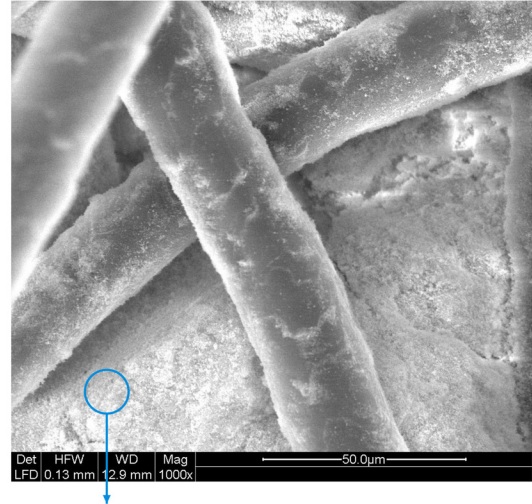
DP: before and after impregnation

Before impregnation



Wool felt

After impregnation



Resin + ZrO₂

SEM x1000 · original scales 50 μm

Wool felt before and after impregnation; resin and ZrO₂ are identified at the original image location.

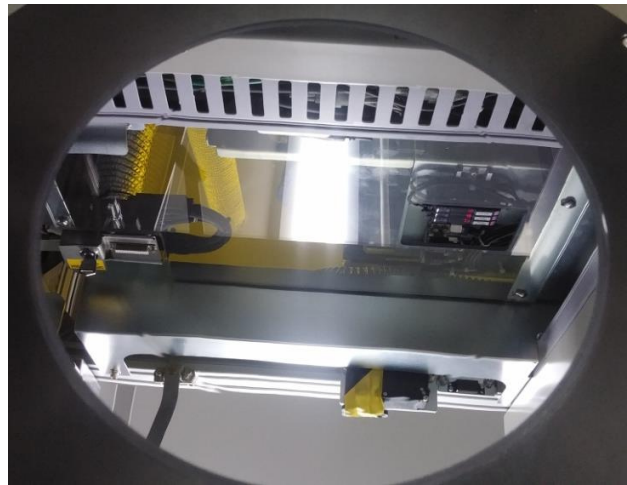
DP-350D-LJC250: process for 8- and 12-inch wafers

The application example specifies 8- and 12-inch silicon wafers. The tool sequence includes the complete specifications for back grinding and the final DP step:

Station	EHWA tool
Z1	BG01-D2-203D4.0W5X-325-RSL
Z2	NP-D2-203D3.0W5X-5000J-VK8B
Z3	DP-350D-LJC250



Silicon wafer in the DP process for 8 and 12 inches from Q219.



Polishing station in the DP process example from Q219.

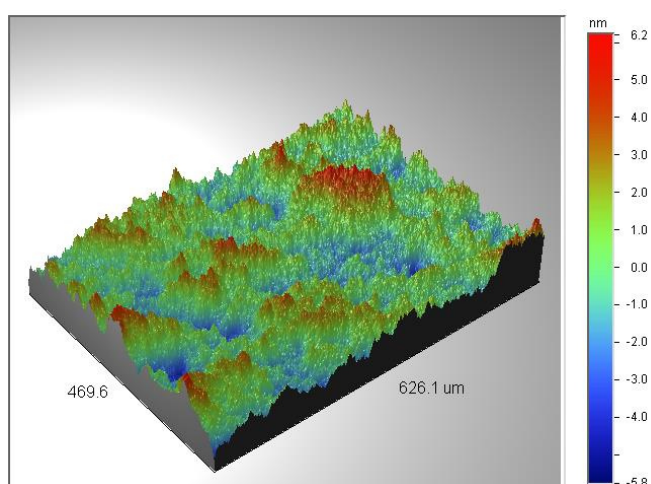
DP: roughness in the detailed process example

Field measurement from Q219, page 4	Specification
Sampling interval	1.0 μm
Objective	20×
Cutoff filter	80.00 μm
Measuring instrument	MP2000+
Average roughness, Ra Average	5.04 $\text{\AA}$



Original field measurement display from Q219 with individual profiles and unchanged measurement information.

Separate optical measurement from Q219	Specification
Ra	1.17 nm
Rq	1.48 nm
Rt	11.97 nm
Measuring instrument	Wyko NT3300
Method	Optical 3D surface measurement



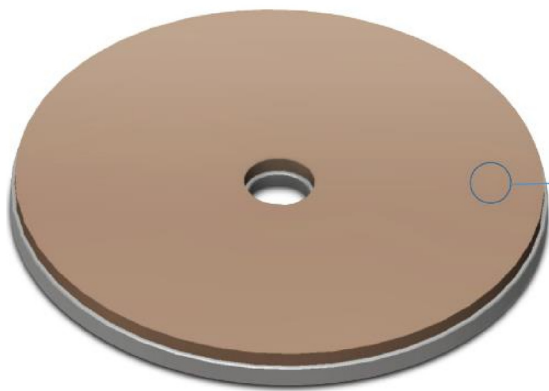
Optical 3D surface from Q219 with the original colour scale in nm and spatial axes.

The 5.04 Å field value belongs to this example; the shorter DP-350D documents specify 1.64 Å. The differences are retained as variants of the respective trial documents. They do not establish a common performance limit.

DP: additional presentation of the tool sequence and measurements

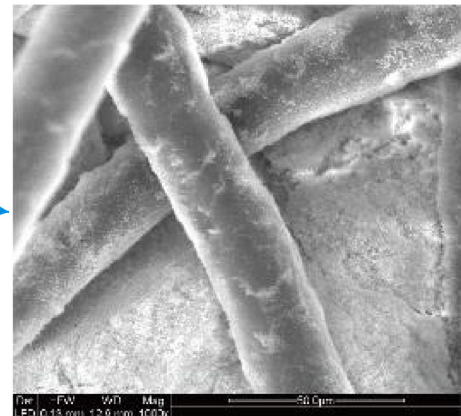
The DP section of the GPP / DP document also shows wool felt and ZrO₂ (250 nm), the before-and-after impregnation comparison, and 8- and 12-inch silicon wafers. The illustrations and tool codes of this version are included in full.

DP: wool felt and ZrO₂ (250 nm)



Polishing wheel

Schematic image relationship · Q232

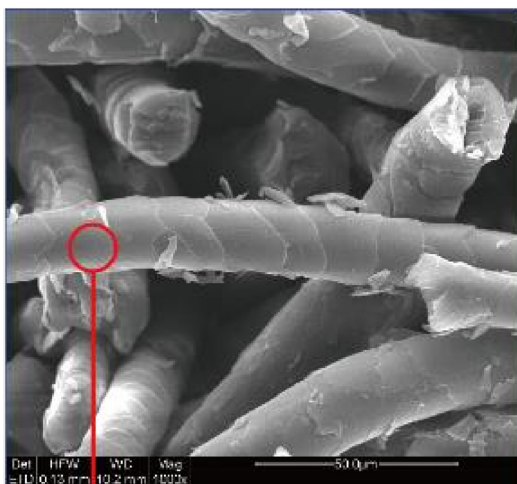


Impregnated felt · SEM ×1000

DP wheel and impregnated wool felt from Q232, page 3.

DP: before and after impregnation

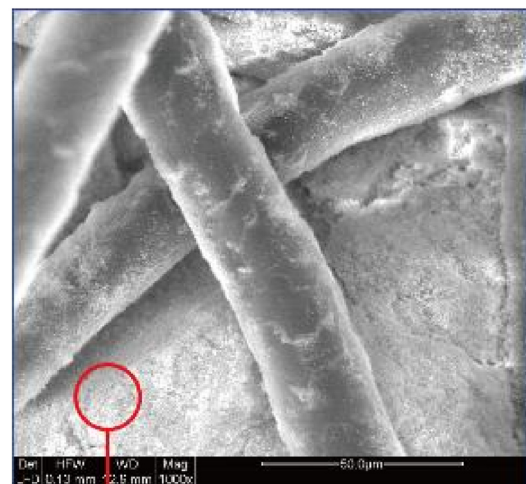
Before impregnation



Wool felt

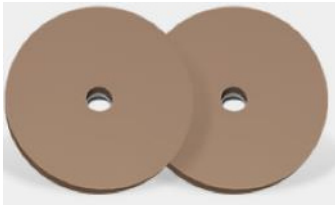
SEM ×1000 · original scales 50 μm

After impregnation



Resin + ZrO₂

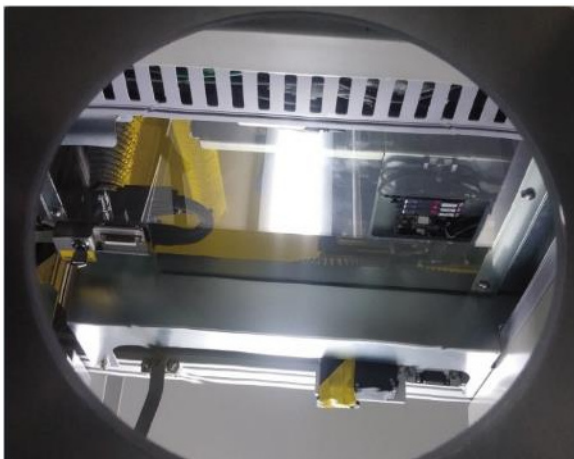
SEM comparison before and after impregnation from Q232, with original markings and scales retained.



Two DP wheels from the GPP / DP presentation.



Silicon wafer in the process example from Q232.



Polishing station in the process example from Q232.

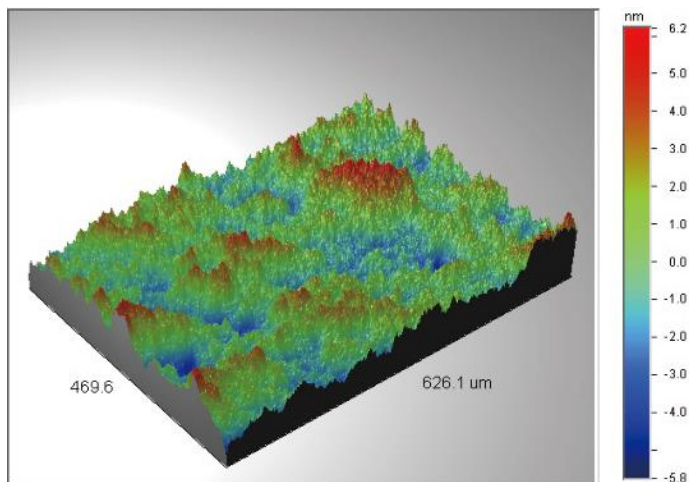
Station	Tool from Q232, page 3
Z1	BG01-D2-203D4.0W5X-325-RSL
Z2	NP-D2-203D3.0W5X-5000J-VK8B
Z3	DP-350D-LJC250

Field measurement from Q232, page 4	Specification
Sampling interval	1.0 μm
Objective	20×
Cutoff filter	80.00 μm
Measuring instrument	MP2000+
Average roughness, Ra Average	5.04 $\text{\AA}$



Field measurement display from Q232 with the original individual profiles.

Separate optical measurement from Q232	Specification
Ra	1.17 nm
Rq	1.48 nm
Rt	11.97 nm
Measuring instrument	Wyko NT3300
Method	Optical 3D surface measurement

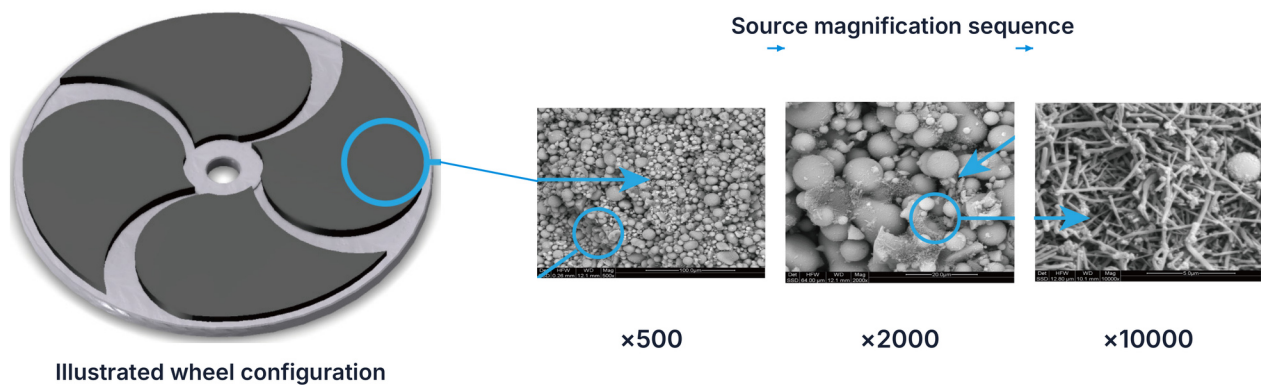


Optical 3D surface from Q232; colour scale and spatial axes retained.

GDP 450D-26T-130H: process and microstructure

The GDP "Sample 1" example describes 12-inch silicon wafers, a Lintec protective tape and the machines listed below. The microstructure is illustrated at $\times 500$, $\times 2000$ and $\times 10000$ magnification; the original scales are 100, 20 and 5 μm . Q005 and Q022 contain the same confirmed identical page, presented together here.

GDP: tool and microstructure



SEM photographs and original scales retained unchanged.
Schematic image relationship · Q005

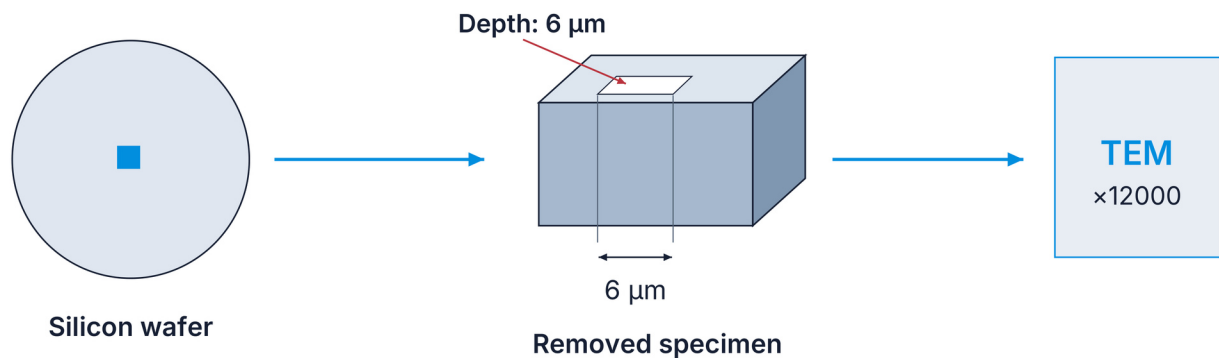
GDP wheel and magnification sequence $\times 500$, $\times 2000$ and $\times 10000$; all SEM scales and original markings retained.

Trial condition	GDP "Sample 1"
Workpiece	Silicon wafer, 12 inches
Back grinding tape	Lintec P-7180 (180 μm)
Machine specification	DGP 8761 (NN2412) & DFM2800
Quantity	10 dummy wafers
Z1	EHWA Back Grinding Wheel
Z2	EHWA Back Grinding Wheel
Z3	EHWA-GDP 450D-26T-130H

GDP: TEM preparation and damage depth

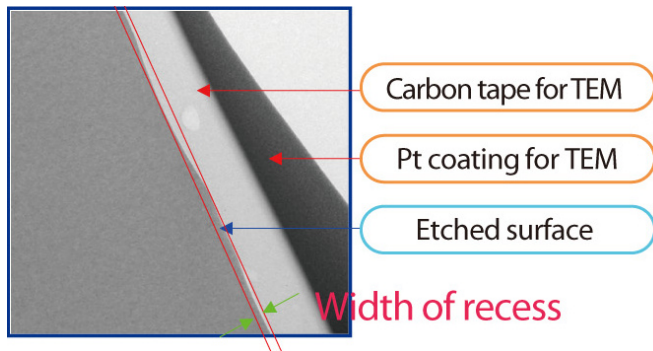
A specimen is removed from the wafer for examination. The preparation diagram identifies a depth of 6 μm and another specimen dimension of 6 μm . The subsequent TEM image is specified at $\times 12000$ magnification. It distinguishes carbon tape for TEM, Pt coating for TEM, the etched surface and the width of the recess.

GDP: TEM specimen preparation

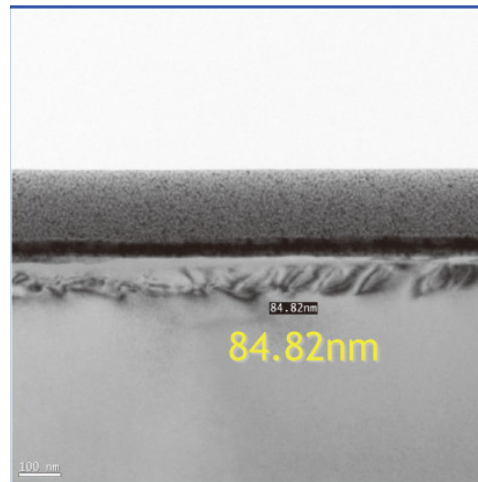


Schematic preparation; dimensions and magnification from Q005 / Q022.

Redrawn preparation diagram with both 6 μm specifications and TEM $\times 12000$.



TEM section with the original arrows and markings: carbon tape, Pt coating, etched surface and width of recess.



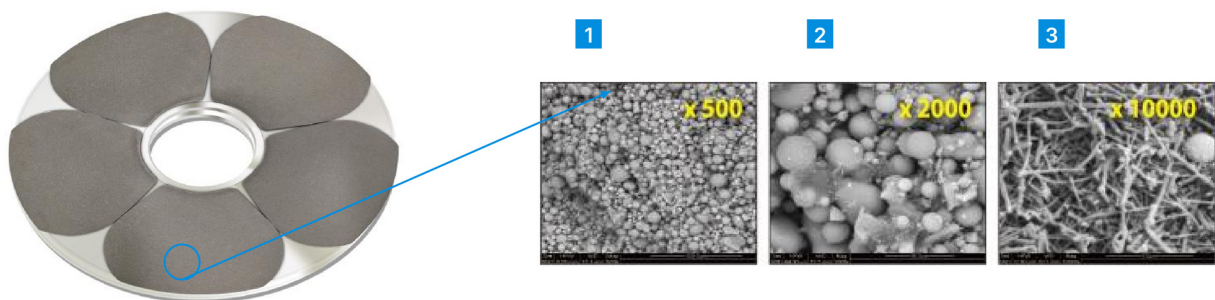
TEM damage depth image with the original 84.82 nm value and original 100 nm scale.

The reported damage depth is 84.82 nm. It describes the illustrated TEM finding in this GDP trial; it is not a general limit for other GDP configurations.

GDP 300D-26T: another machine trial

Another GDP configuration shows a wheel with five polishing areas and a wheel pair. The three SEM structures are labelled $\times 500$, $\times 2000$ and $\times 10000$; their sequence is additionally identified by 1, 2 and 3.

GDP: tool and microstructure



Illustrated wheel configuration

SEM photographs and original scales retained unchanged.
Schematic image relationship · Q220

GDP wheel and three numbered SEM structures from Q220, page 1.

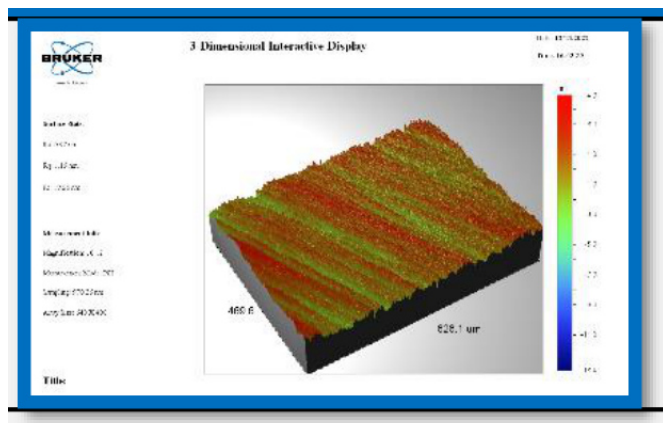


Two GDP wheels from the Q220 presentation.

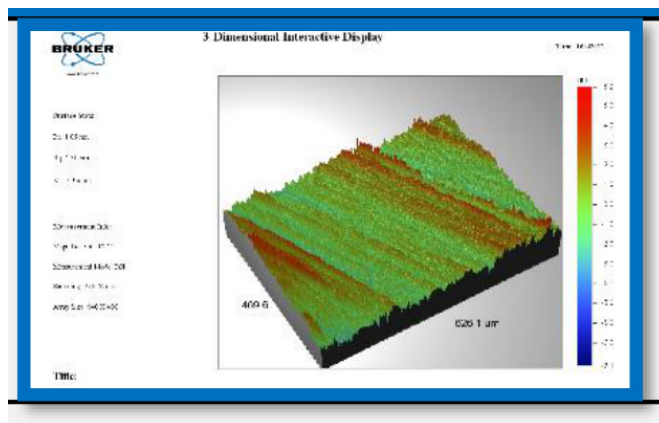
Trial condition	GDP from Q220
Workpiece	Silicon wafer, 12 inches
Back grinding tape	AMC APB1-330
Machine	INSEMITEC IVG 3030
Quantity	10 dummy wafers
Z1	EHWA Back Grinding Wheel
Z2	EHWA Back Grinding Wheel
Z3	EHWA-GDP 300D-26T

GDP: surface roughness and die strength

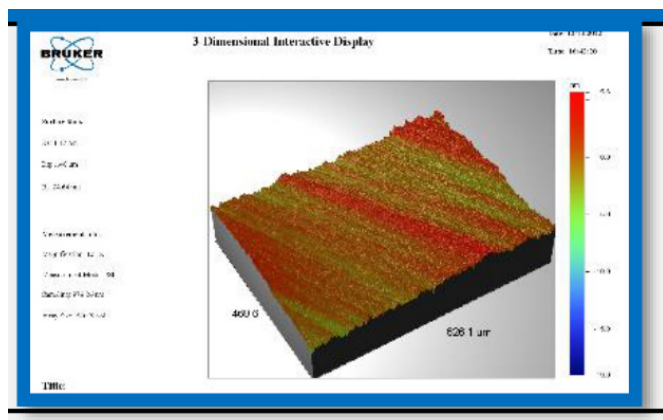
Measurement position	Ra in the GDP trial from Q220
Center	0.92 nm
Middle	1.05 nm
Edge	1.17 nm



GDP surface measurement at the center; original measurement display and 3D surface retained.



GDP surface measurement in the middle; original measurement display and 3D surface retained.



GDP surface measurement at the edge; original measurement display and 3D surface retained.

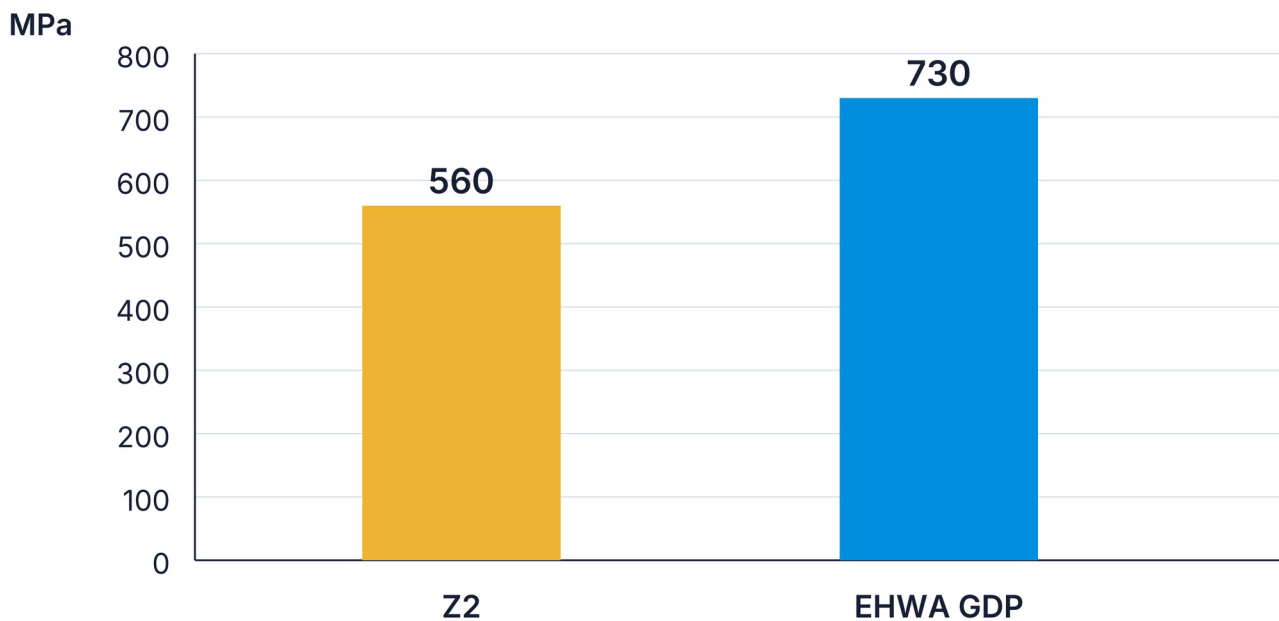


Additional illustrated GDP wheel configuration with four polishing areas.

The strength comparison specifies 560 MPa after Z2 and 730 MPa for EHWA GDP. It shows higher die strength after the GDP step in the described trial. The test is labelled "Die Strength"; the test method and final thickness are not detailed here.

Comparison	Die strength
Z2	560 MPa
EHWA GDP	730 MPa

Die strength in the application trial



Result of the described trial; not a general strength guarantee.

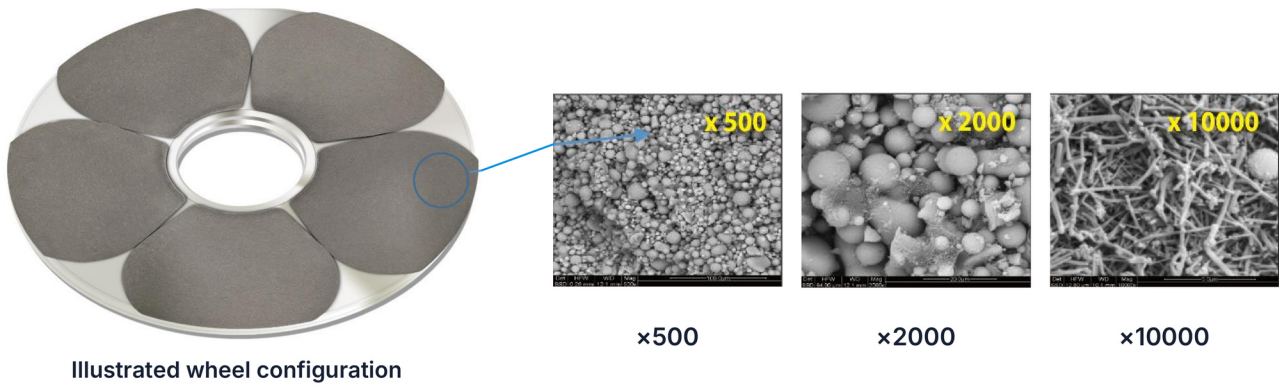
Q220 · Z2 / GDP

Die strength: Z2 560 MPa and EHWA GDP 730 MPa; axis 0-800 MPa.

GPP: Gettering Polishing Pad

The GPP example shows a configuration with five polishing areas, a wheel pair and three SEM structures at $\times 500$, $\times 2000$ and $\times 10000$. The corresponding original scales are 100, 20 and 5 μm . A DISCO DGP8761 process is specified for this example.

GPP: tool and microstructure



SEM photographs and original scales retained unchanged.
Schematic image relationship · Q232

GPP wheel and three SEM structures from Q232, page 1.

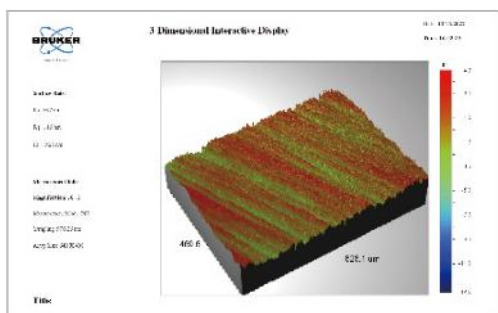


Two GPP wheels from the illustrated range.

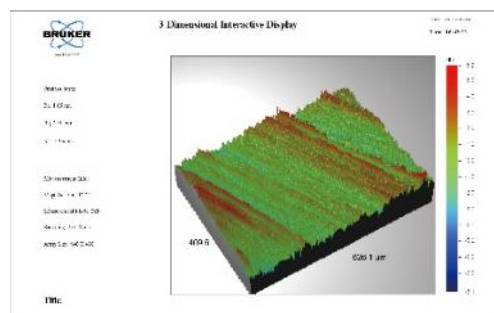
Trial condition	GPP from Q232
Workpiece	Silicon wafer, 12 inches
Back grinding tape	AMC APB1-330
Machine	DISCO DGP8761
Quantity	10 dummy wafers
Z1	EHWA Back Grinding Wheel
Z2	EHWA Back Grinding Wheel
Z3	EHWA-Gettering Polishing Pad

GPP: surface measurement and strength comparison

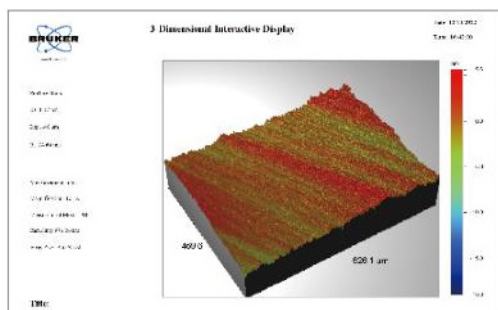
Measurement position	Ra in the GPP trial from Q232
Center	0.92 nm
Middle	1.05 nm
Edge	1.17 nm



GPP surface measurement at the center with the original measurement display and colour scale.



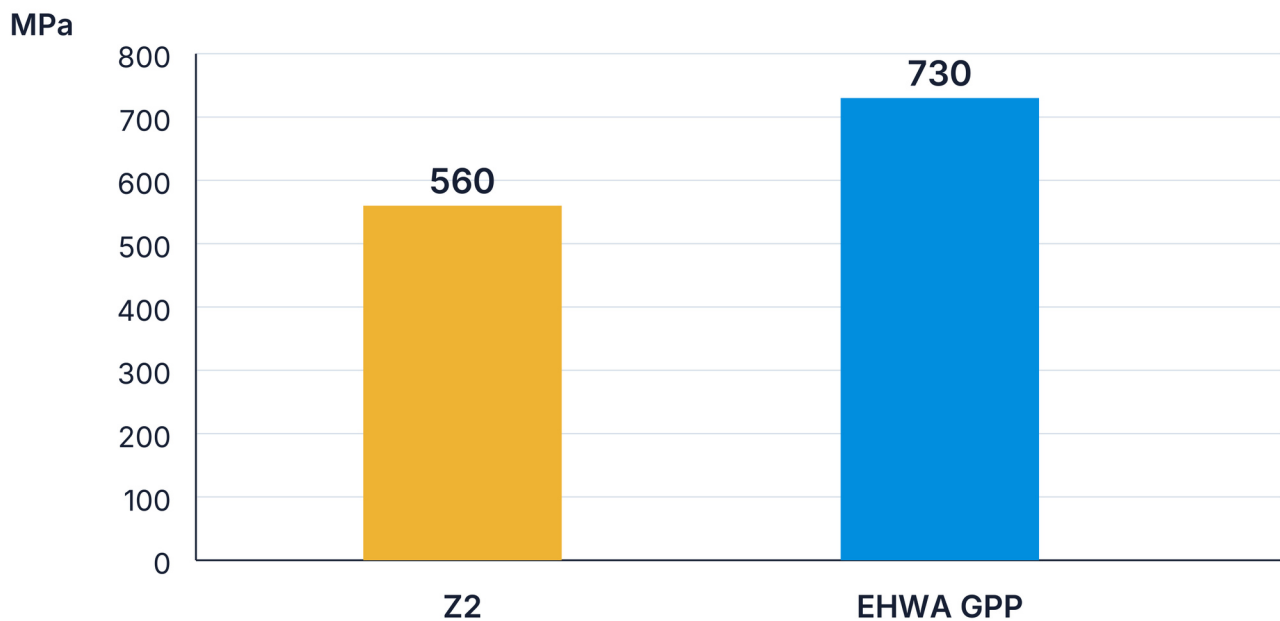
GPP surface measurement in the middle with the original measurement display and colour scale.



GPP surface measurement at the edge with the original measurement display and colour scale.

Comparison	Die strength
Z2	560 MPa
EHWA GPP	730 MPa

Die strength in the application trial



Result of the described trial; not a general strength guarantee.

Q232 · Z2 / GPP

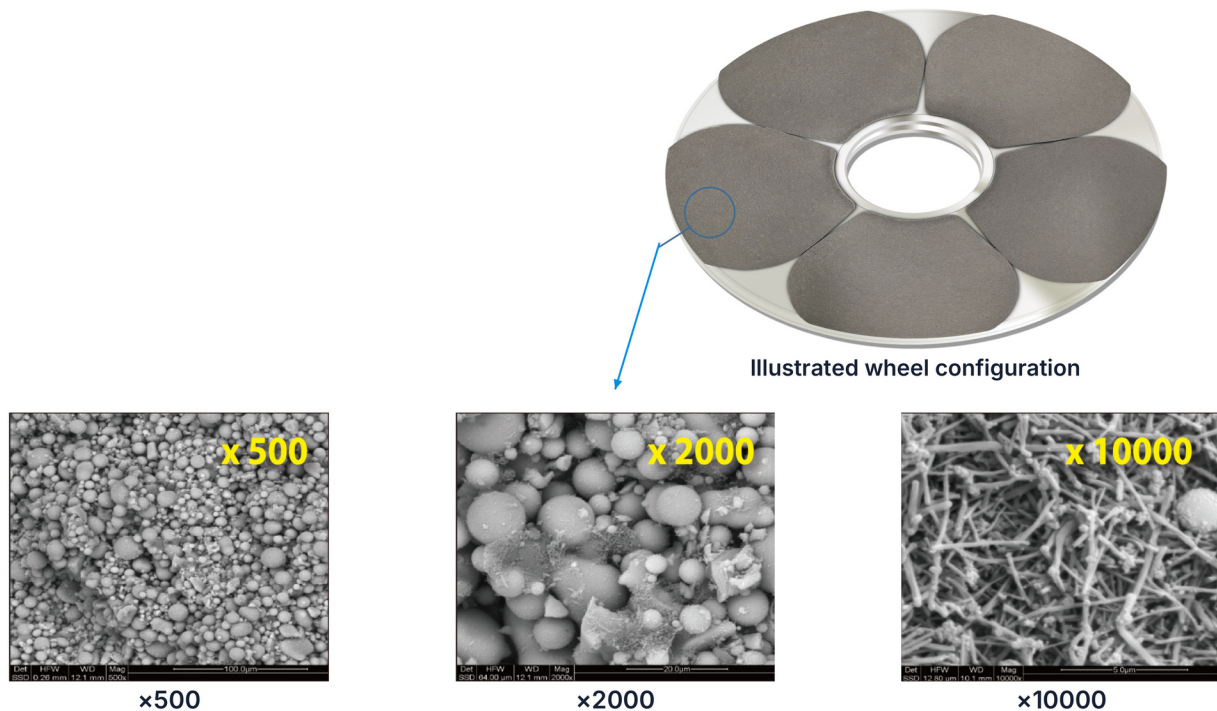
Die strength: Z2 560 MPa and EHWA GPP 730 MPa; axis 0-800 MPa.

The comparison shows higher die strength after the GPP step under the described trial conditions. The figures belong to the GPP example; matching results in the separate GDP example do not establish that the tools are generally equivalent. The test method and final thickness are not specified in this presentation.

GDP pad: additional tool presentation

The additional GDP pad document specifies the same "EHWA-Gettering Polishing Pad" name for Z3 and shows a wheel with five polishing areas, a wheel pair and SEM structures at $\times 500$, $\times 2000$ and $\times 10000$. It contains the following process conditions without adding separate roughness or strength values:

GDP pad: tool and microstructure



Illustrated wheel configuration

$\times 500$

$\times 2000$

$\times 10000$

Schematic image relationship · original scales retained unchanged.

GDP pad and SEM structures from Q273 with the original marking and 100, 20 and 5 μm scales.



Two GDP pads from the additional tool presentation.

Trial condition	GDP pad from Q273
Workpiece	Silicon wafer, 12 inches
Back grinding tape	AMC APB1-330
Machine	DISCO DGP8761
Quantity	10 dummy wafers
Z1	EHWA Back Grinding Wheel
Z2	EHWA Back Grinding Wheel
Z3	EHWA-Gettering Polishing Pad

Adapt the polishing process to your wafers

To select the tool, provide wafer material and diameter, initial and final thickness, frontside structure, protective tape, machine and Z1 / Z2 tools. Add the required roughness with measurement method and positions, together with requirements for die strength, gettering, stock removal and cycle time. EHWA Europe can help match the tool and process to this information.

[Technical enquiry to EHWA Europe](#) · Telephone +49 6173 99778-0

Technical basis

EHWA documents: Dry Polishing Wheel DP (Q004 and Q019, 1 page each); GDP Wheel (Q005 and Q022, 1 identical page each); DP Wheel (Q219, pages 1-4); GDP Wheel (Q220, pages 1-2); GPP / DP (Q232, pages 1-4); GDP Gettering Dry Polishing Pad (Q273, 1 page). All reported trial values apply to the respective investigation described.

The additional process explanation is supported by [DISCO: dry polishing](#) and [DISCO: Gettering DP](#). These sources explain the process; their separate product and trial values are not transferred into the EHWA tables.