

Semiconductors: back grinding, dicing and CMP conditioning

EHWA tools for back grinding, microblades, dicing and CMP conditioning, including tool series, dimensions, structure comparisons and application examples.



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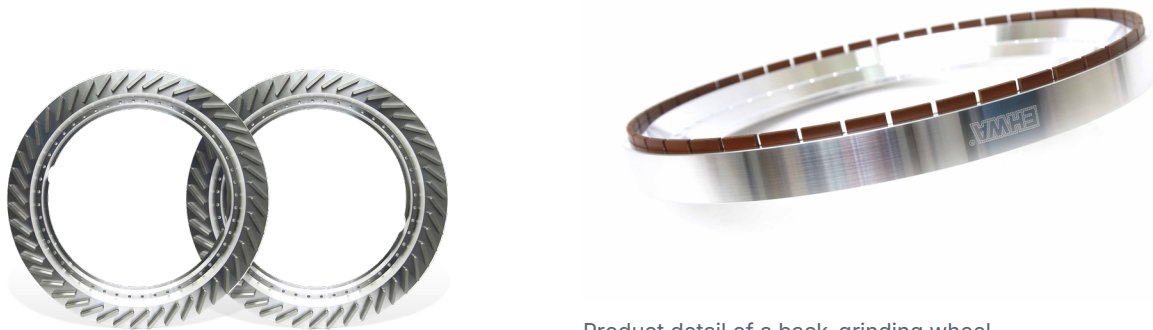
Design the tool and process together

Back-grinding wheels, microblades, dicing blades and CMP pad conditioners

EHWA DIAMOND - since 1975

This programme combines material removal during back grinding, wafer and package singulation, and CMP pad conditioning. EHWA provides different bonds, cutting structures and tool forms for these operations. The material, machine, cutting or grinding conditions and required surface determine the selection.

Back grinding with resin and metal bonds



Product detail of a back-grinding wheel.

Back-grinding wheels with segmented grinding surfaces.

The EHWA programme covers different machine types, applications and grinding methods, including designs for grinding several wafers simultaneously. It is designed for long wheel life and high bulk removal rates. Wheel construction and process parameters are matched to the machine and grinding method.

Listed applications are silicon wafers, sapphire wafers, silicon carbide wafers, glass wafers and high-hardness materials such as zirconia. The document distinguishes rough and fine grinding:

Process	Bond series	D (mm)	W (mm)	X (mm)	Grit designation
Rough grinding	RS, MS Series	200-380	2-5	3-10	#170-#800
Fine grinding	SW Series	200-380	2-5	3-10	#1200-#4000

D, W and X are the dimensional labels in the EHWA specification. Their definitions, wheel mounting and processing sequence are agreed during tool selection.

Microblades: bond programme and cutting performance



Thin microblades in different designs.



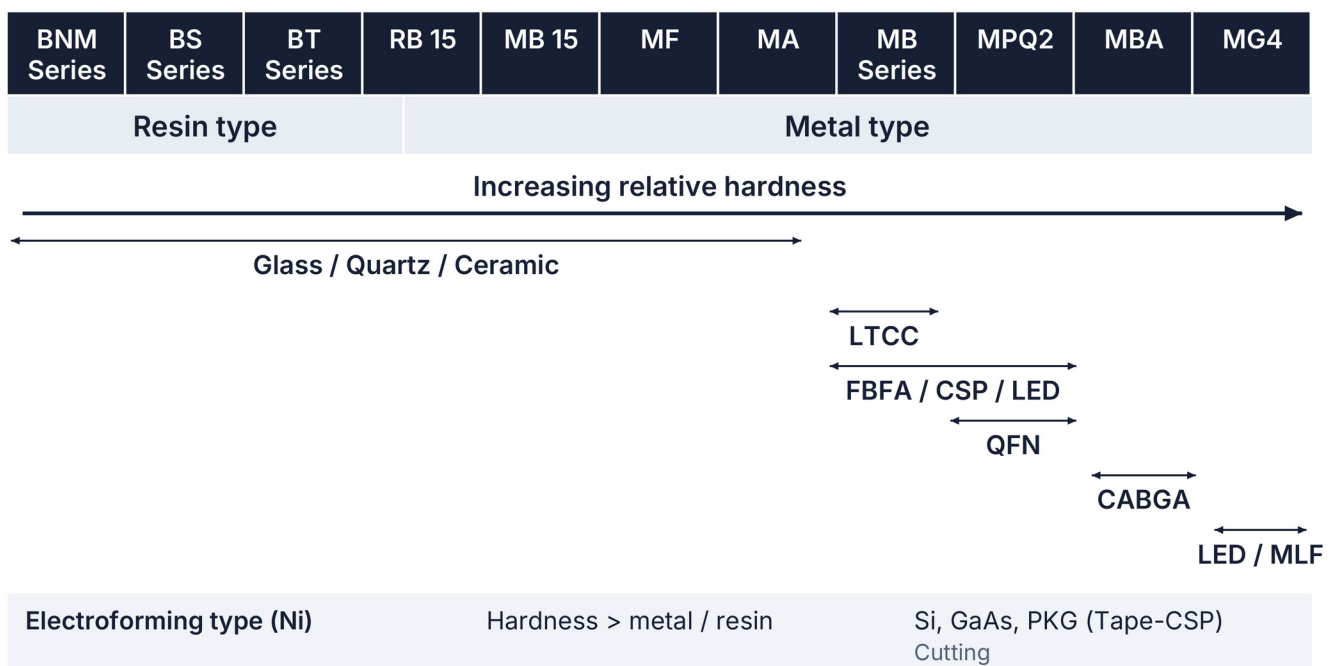
Individual microblade design.

The thin precision blades are designed for efficient cutting. EHWA describes free-cutting action at high rotational speeds and fast feed rates, together with reduced chipping during sawing. Cutting quality, feed rate and tool wear are matched to the actual material structure.

The selection matrix presents the following series in the direction of increasing relative hardness:

Position in the selection matrix	EHWA designation
1	BNM Series
2	BS Series
3	BT Series
4	RB 15
5	MB 15
6	MF
7	MA
8	MB Series
9	MPQ2
10	MBA
11	MG4

Microblades: relative hardness and application ranges



Microblade selection matrix showing resin/metal regions, relative hardness direction and application ranges.

The matrix shows application ranges for glass, quartz and ceramics, as well as LTCC, FBFA/CSP/LED, QFN, CABGA and LED/MLF. The range arrows support series selection according to the material and package structure. The resin/metal boundary runs within the RB 15 column; the specific bond design is matched to the application.

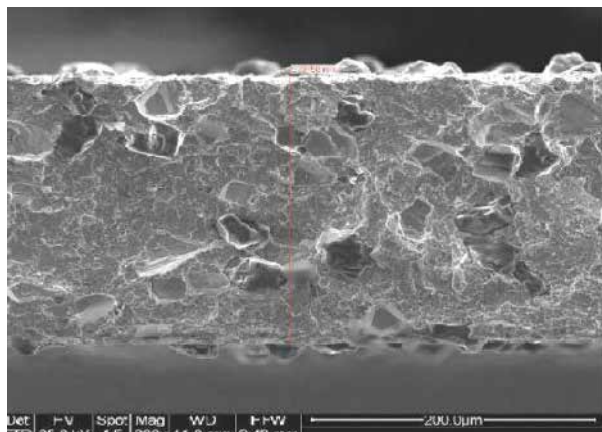
Electroformed designs with a nickel bond (Electroforming Type) form a separate group. In this qualitative selection, EHWA places their hardness above the illustrated metal/resin types and lists cutting Si, GaAs and Tape-CSP packages.

Side enhancement: control contact with copper structures

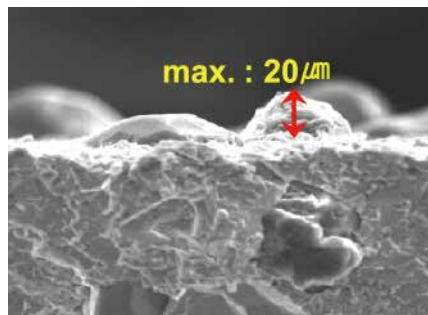
The structure comparison distinguishes a conventional blade side from a side-enhanced design. Diamonds protruding from the blade side can contact copper wiring in the illustrated PCB/EMC structure. The enhanced side avoids this lateral contact in the example shown.

Image example	Marking in the detailed image	Statement illustrated by the structure diagram
Conventional side	maximum 20 µm	Side diamond exposure; possible interference with copper wiring
Side-enhanced design	maximum 6 µm	No side diamond exposure in the illustrated example; no contact with copper wiring

The 20/6 μm values belong to the marked local surface details. They do not describe the overall thickness of every microblade.

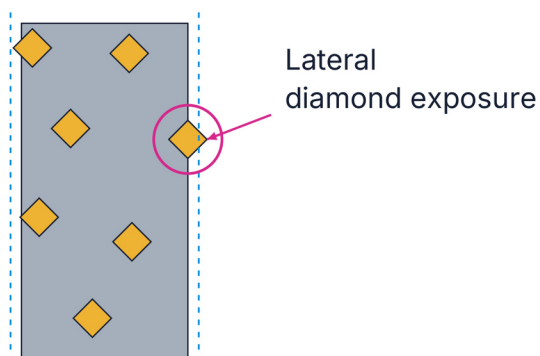


SEM image of the conventional blade side with instrument scale.

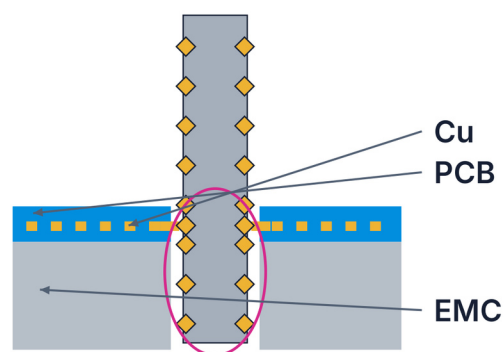


Conventional side detail with a measurement annotation of maximum 20 μm .

Conventional blade side

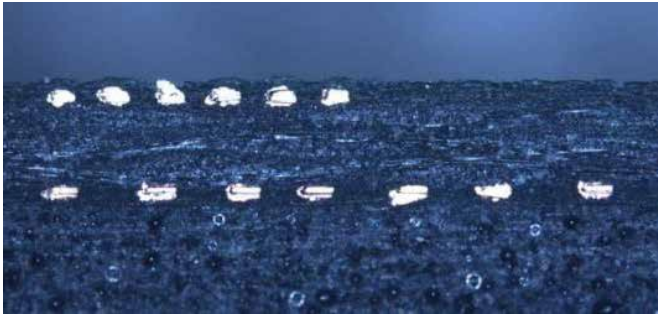


Schematic illustration

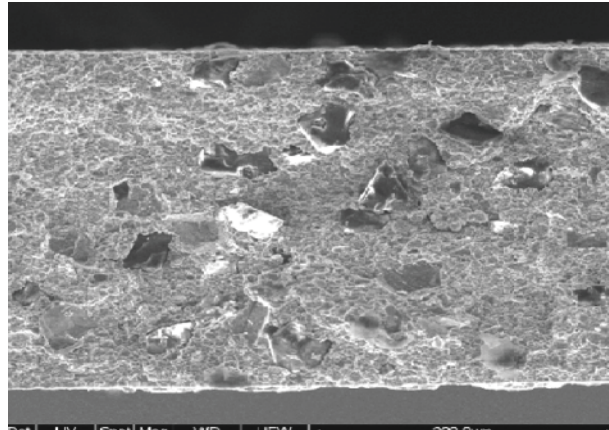


Possible copper-wiring interference
in the illustrated structure

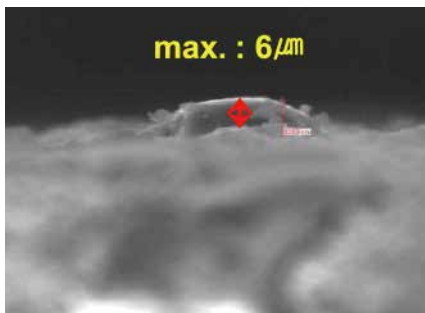
Conventional side structure showing diamond exposure and PCB, Cu and EMC relationships.



Cut image of the conventional structure.

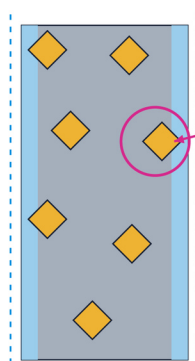


SEM image of the side-enhanced design.



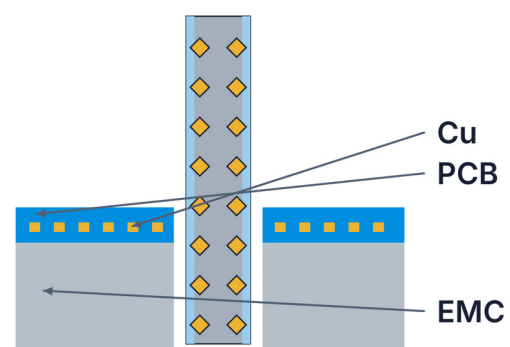
Side enhancement detail with a measurement annotation of maximum 6 μm .

Side-enhanced blade



No lateral
diamond exposure

Schematic illustration



No copper-wiring interference
in the illustrated structure

Side-enhanced structure without lateral diamond exposure in the illustrated example.



Cut image of the side-enhanced structure.

Dicing blades: thin cuts and controlled chipping



EHWA hub-type dicing blades.



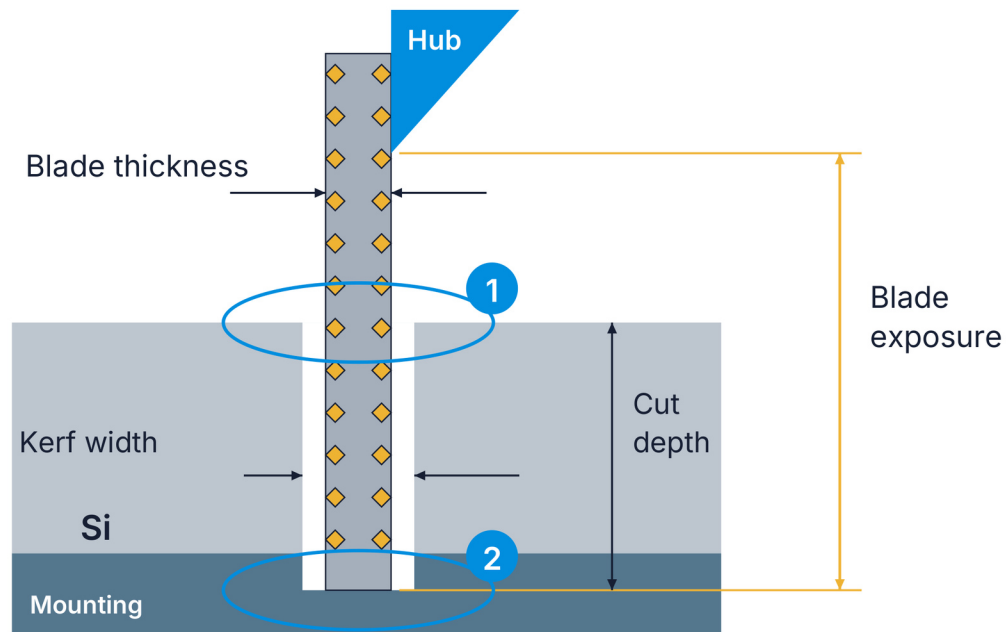
Product detail of a dicing blade.

EHWA offers particularly thin, accurate dicing blades. Controlled diamond particle and grit-size distribution supports low chipping and consistent cutting quality. Suitable high feed rates can improve productivity. The tool and process are designed for the customer's application.



Dicing during processing.

Si-wafer dicing: tool and cut geometry



1: Top edge · 2: Backside edge

Schematic illustration

Silicon wafer dicing: hub, blade thickness, exposure, kerf width, cut depth and wafer mounting; top and backside measurement positions.

The diagram distinguishes the top edge (position 1) from the backside edge (position 2). Finer diamond grits are associated with small top-side chips. Coarser grits can influence backside cutting quality through their cutting ability and reduced loading on individual grains. These relationships are considered together with blade thickness, exposure, kerf width, cut depth and mounting.

During blade dicing, water is supplied to cool the processing point and remove cutting particles. The specific coolant arrangement is matched to the machine and application.

Bond development for silicon and compound semiconductors

EHWA describes a bond development for silicon and compound semiconductors. The objectives are small top-side and backside chips and improved productivity through suitable high feed rates. The document illustrates these objectives with two cut images:



Cut image showing top-side chipping: Top Chipping.

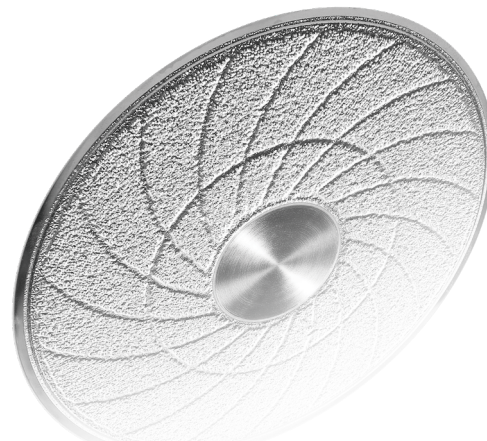


Cut image of the side and backside edge: Side and Back Chipping.

BSL CMP conditioners: diamond retention and pad surface



BSL CMP pad conditioner.

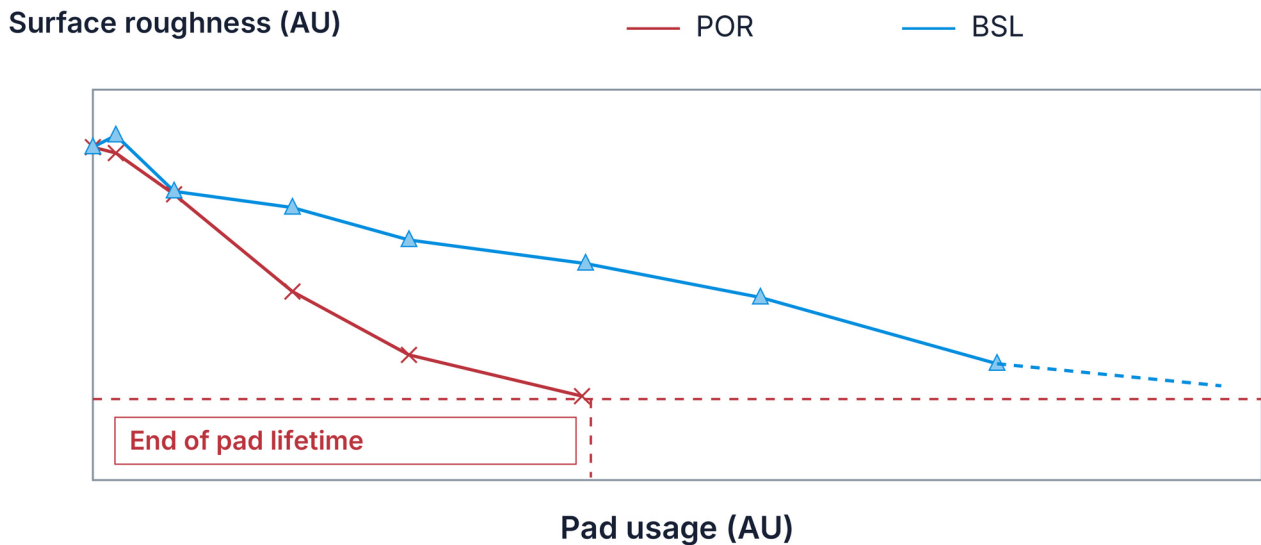


Product detail of the BSL conditioner surface.

BSL combines mechanical contact and chemical bonding to retain diamonds. EHWA describes a carbide interface between diamond and bond material as a contribution to corrosion resistance. Using the diamond edges supports long useful life. High diamond exposure creates space for removed pad material and supports conditioning efficiency and debris removal.

Proprietary brazing technology and controlled diamond orientation support a high, sustained Pad Cut Rate (PCR) and the required pad roughness. PCR describes removal from the pad. It is distinguished from the removal rate on the wafer.

BSL: pad roughness against pad usage



Qualitative comparison; AU = arbitrary units

Qualitative comparison of pad surface roughness against pad usage: POR and BSL with the indicated lifetime threshold.

The qualitative comparison shows pad usage and surface roughness in arbitrary units (AU). In the illustrated example, BSL maintains pad roughness above the lifetime threshold longer than the comparison curve labelled POR.

A long-lasting BSL conditioner can support longer pad use, higher CMP equipment availability and fewer pad changes. This creates the potential for lower cost of consumables (CoC). The effect is considered together with the pad, slurry and CMP process.

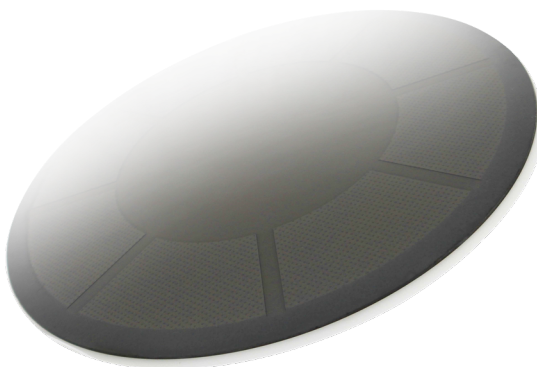
CVD CMP conditioners: design geometry and process performance



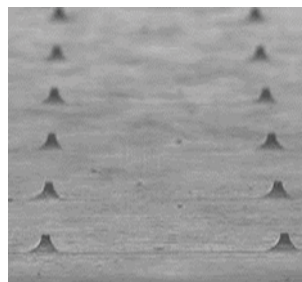
CVD diamond-coated CMP pad conditioner.



CVD conditioners with different surface patterns.



Product detail of a CVD conditioner surface.



Micrograph of the CVD tip arrangement.

Under the principle of engineered quality control, EHWA identifies the following properties:

- A chemically stable, inert diamond surface.
 - Good disk flatness with uniform tip size and exposure.
 - Adjustment of Pad Cut Rate (PCR) and Wafer Removal Rate (WRR) through tip geometry, exposure and shape.
 - Consistent PCR and WRR sustained over polishing time as a design objective.
- WRR here describes material removal from the wafer; PCR describes removal from the pad. Both parameters are influenced by the conditioner structure.

Diamond-coated tips can be arranged in different patterns. Flat contact faces at the tip apex and the tip design allow the load applied to each tip to be adjusted. EHWA refers to patents concerning tip size and number in the technical document.

Contact geometry retained over conditioning time can support consistent PCR. Selection therefore considers the contact area, number and distribution of working tips as well as the diamond coating.

Ring, pellet and bar designs for CMP



Ring-type CMP pad conditioner.

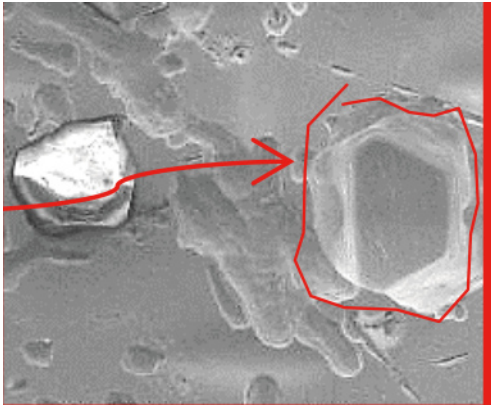
CMP conditioners in disk, ring, pellet and bar forms.

EHWA describes BSL and CVD technologies for large conditioning disks, bar forms, ring forms and designs for legacy CMP tools. The geometry is matched to the existing tool.

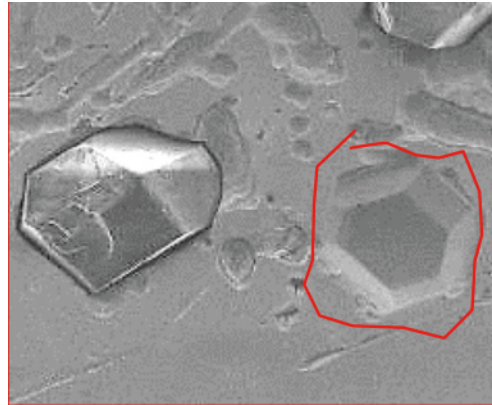
Proprietary brazing powders and high-temperature/vacuum brazing support strong diamond retention. EHWA describes the connection as a dual bonding mode: mechanical retention and chemical bonding.

Image comparison of diamond retention

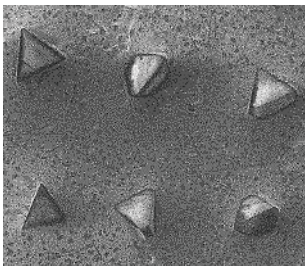
Conditioner in the image comparison	Reported operating time	Image observation reported by EHWA
Electroplated disk	20 h	Heavy diamond loss observed
EHWA BSL disk	60 h	No diamond loss observed



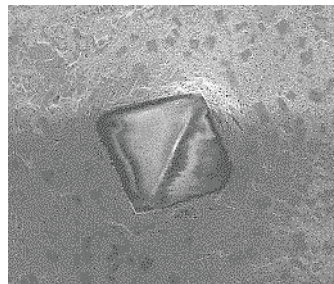
Electroplated disk after 20 h: first image showing diamond loss.



Electroplated disk after 20 h: second image showing diamond loss.



EHWA BSL after 60 h: first image without observed diamond loss.



EHWA BSL after 60 h: second image without observed diamond loss.

The images show different operating times; further comparison conditions are not specified.

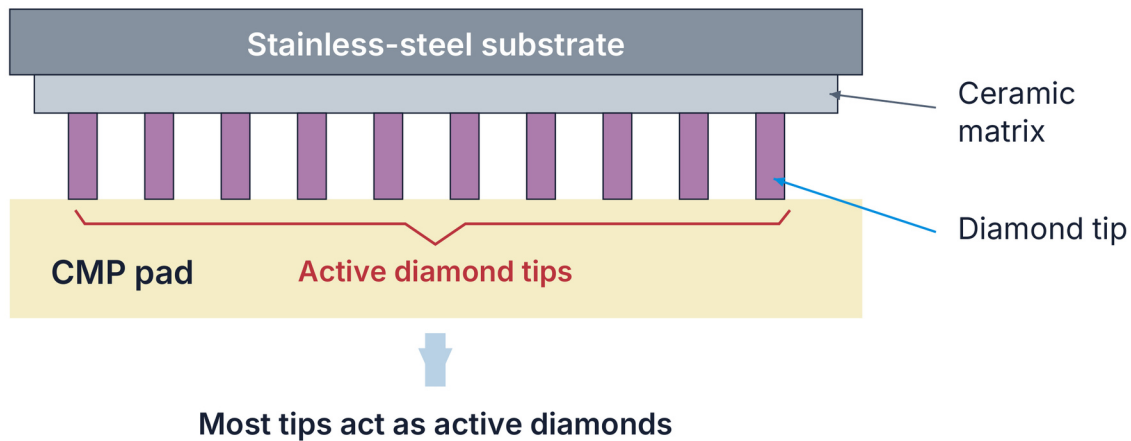
Uniform tip height and multiple pad cycles

BSL brazing and orientation technology supports sustained PCR. For CVD, EHWA qualitatively describes very small ("near-zero") tip-height variations to reduce wafer defects and unwanted topography. Customised tip configurations allow adjustment of PCR, pad roughness and Material Removal Rate (MRR) on the wafer.



CVD conditioner as a product example for the contact structure.

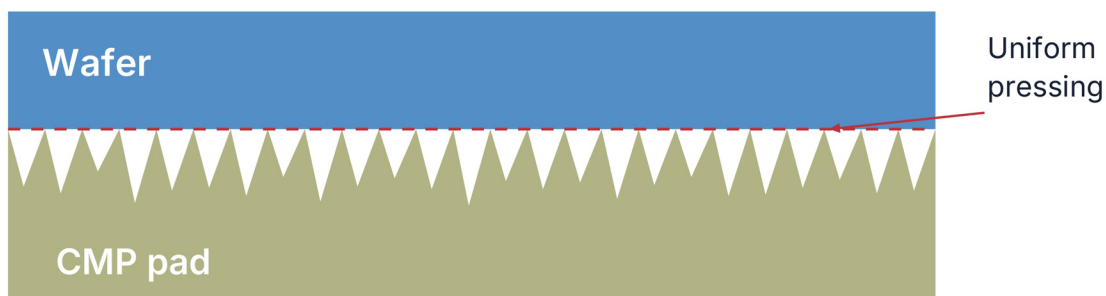
CVD conditioner: diamond-tip contact



Schematic illustration

CVD contact structure: stainless-steel substrate, ceramic matrix, diamond tips and CMP pad; most tips work actively.

Uniform pressure transfer to the CMP pad

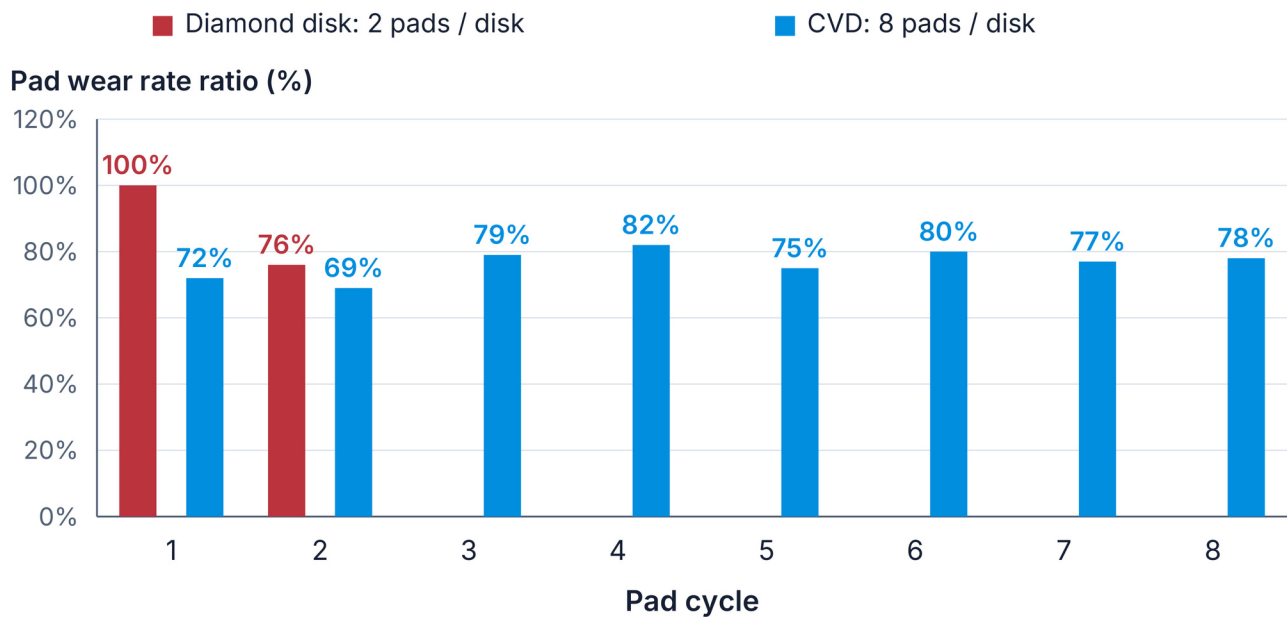


Schematic illustration

Diagram of uniform pressure transfer between the wafer and structured CMP pad.

Low diamond wear can enable a CVD conditioner to be used across several pads and lower cost of consumables per wafer. EHWA also identifies the CVD technology as pad conditioning for high MRR in SiC CMP and as a Process of Record (POR). The design is matched to the particular SiC process.

Relative pad wear rate ratio over eight cycles



Diamond disk: No values reported for cycles 3–8.

Example of the relative pad wear rate over eight cycles: diamond disk and CVD disk.

Pad cycle	Diamond disk: relative pad wear rate ratio	CVD disk: relative pad wear rate ratio
1	100%	72%
2	76%	69%
3	no value shown	79%
4	no value shown	82%
5	no value shown	75%
6	no value shown	80%
7	no value shown	77%
8	no value shown	78%

The example shows two pads per diamond disk and eight pads per CVD disk. The percentages describe the relative pad wear rate ratio; no diamond-disk values are given for cycles 3–8. Pad life and replacement intervals are matched to the specific CMP process.

Discuss your semiconductor application

For back grinding and dicing, useful information includes material structure, wafer/package dimensions, machine, mounting, current tool specification and required quality. Add known feed rates, rotational speeds, coolant arrangements and observed chipping.

For CMP, the tool type, pad, slurry, existing conditioner, PCR, wafer removal rate, surface requirements and replacement intervals are useful. Available information is enough to start; further details can be developed in the technical discussion.

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