



Introduction of wafer edge treatment by polishing film

What the edge polishing by polishing films provides?

- Alternative way to process the wafer edge
- Different from edge grinder, slurry, the chemical process for edge
- Edge treatment is just for yield improvement and won't solve the big problem in semiconductor industry, but the tool to overcome other tools weak point is needed. Polishing film is sometimes better than other method
- Flexible roughness changes, bevel shape and...
- Mechanical polish by polishing tape



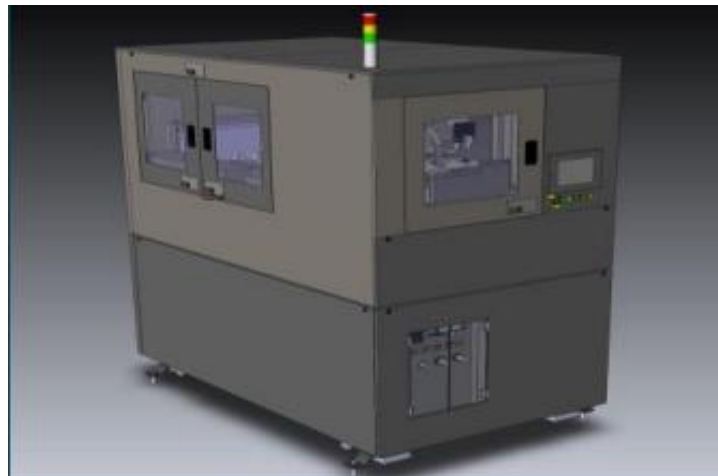
Polishing tool for semiconductor: Edge Polisher



HT Serise(For 12inch wafers)



NME Series(For 6-12inch wafers)



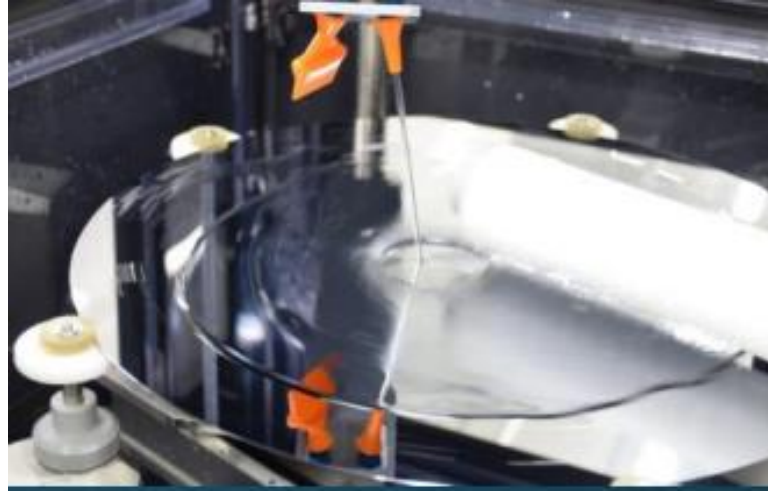
SFF Serise(For 2-8inch wafers)



Notch polishing



Edge Polish



Three feature of edge polish by polishing tape

1. Control edge shape



2. Control Roughness

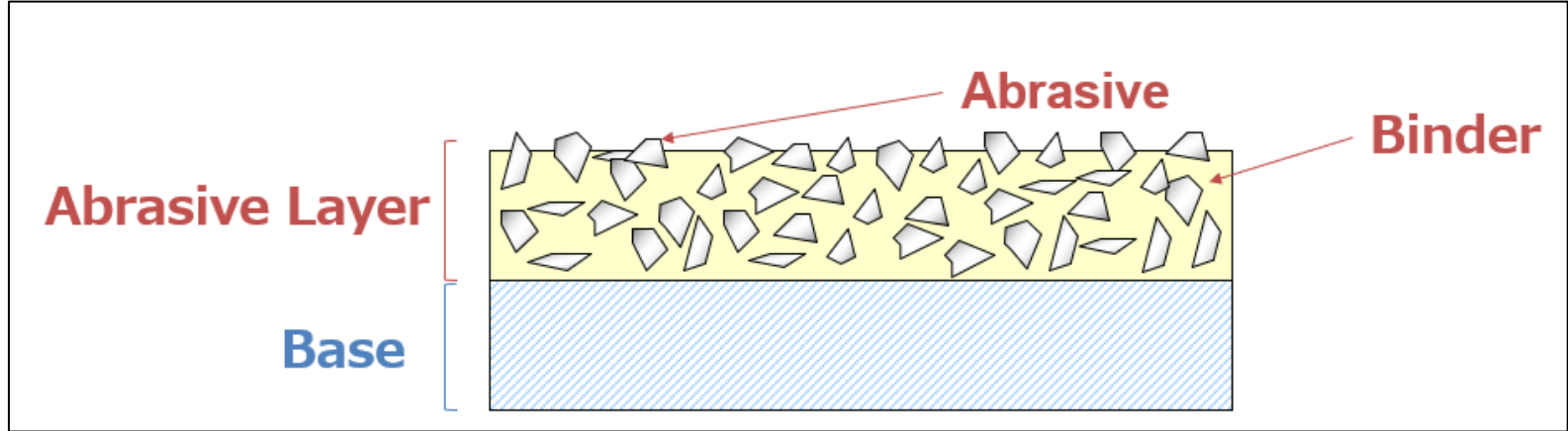


3. Polish various materials and layers

Silicon, Silicon carbide, Gallium Nitride, Gallium arsenide, Diamond, Polycrystal GaN-on-Si layer, Silicon oxide layer, aluminium, copper etc,

Polishing tape general info

Mesh Size	um	WA (AO)	GC (SC)	Dia
600	30	●/60μ	●/40μ	●/45/60/80μ
800	20	●	●	
1000	16	●	●	
1200	15			●
1500	12	●		
2000	9	●	●	●
3000	5	●	●	●
4000	3	●	●	●
6000	2	●	●	●
8000	1	●	●	●
10000	0.5	●	●	●
15000	0.3	●(AWA)		
20000	0.2	●(AWA)		●
	0.03			
Abrasive		Aluminum Oxide	Silicon Carbide	Diamond



The structure of polishing film



Polishing tape

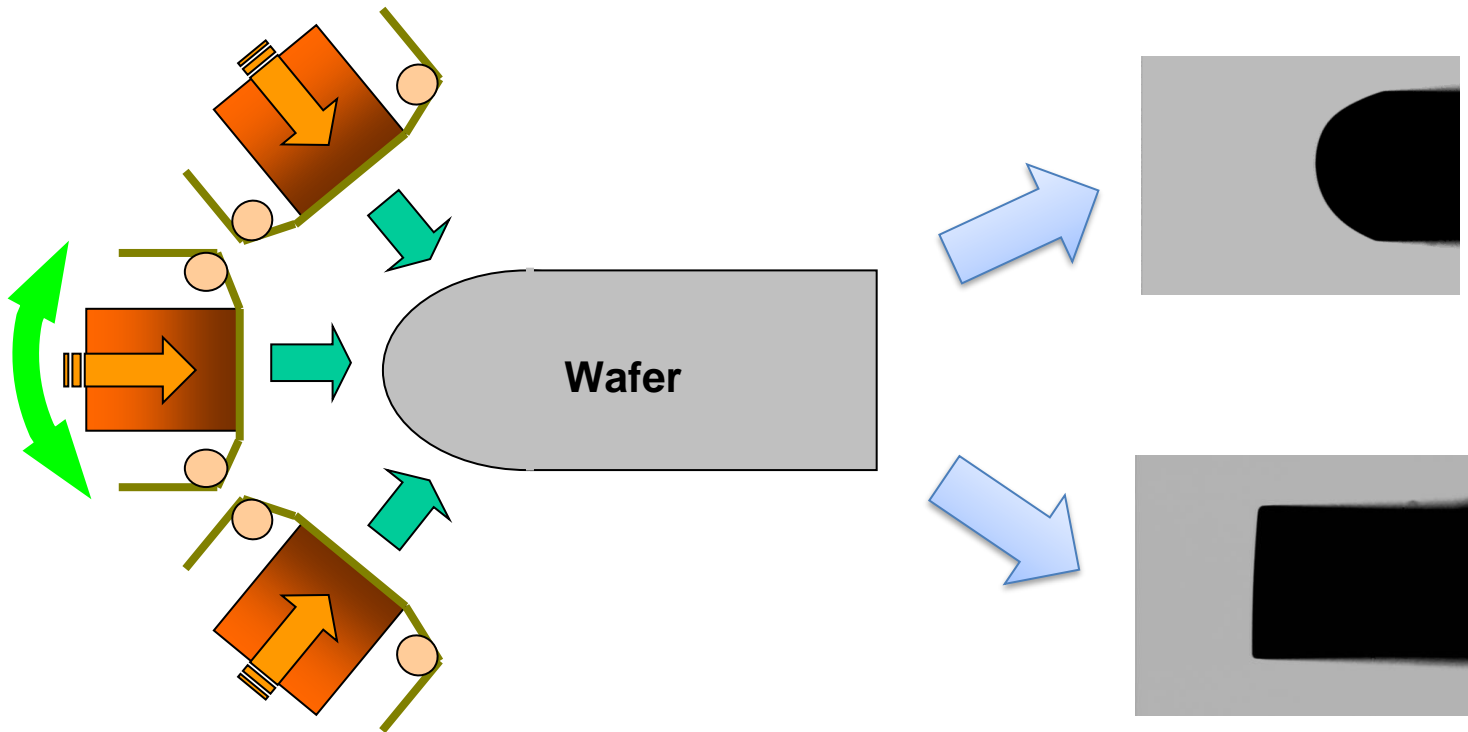


Edge polisher Video

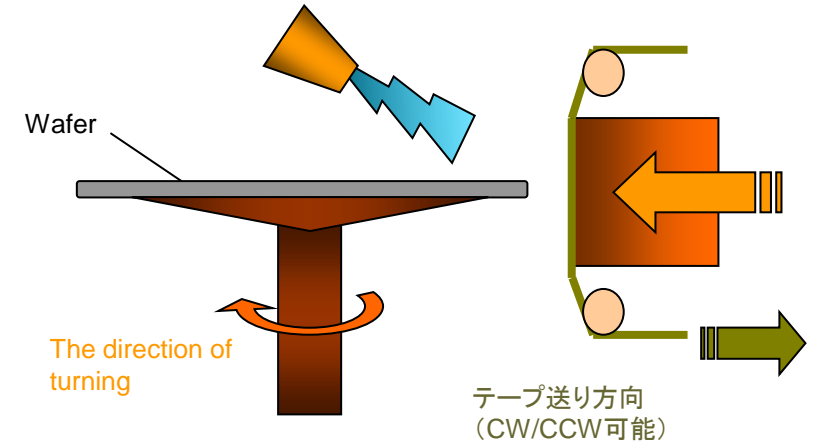
Edge polishing mechanism

Unique polishing unit to process the wafer edge efficiently.

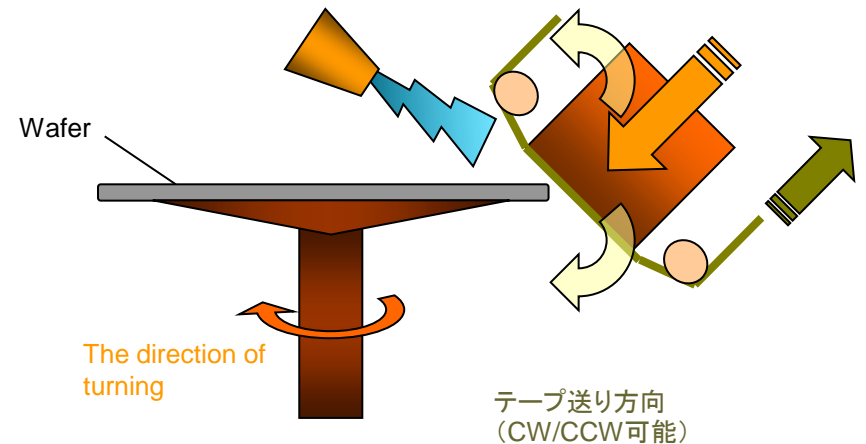
- Less diameter reduction
- Follow the edge shape by soft pad the inside of the tape
- Easy to change the polishing tape
=> change the roughness and shape easily



Flat polishing



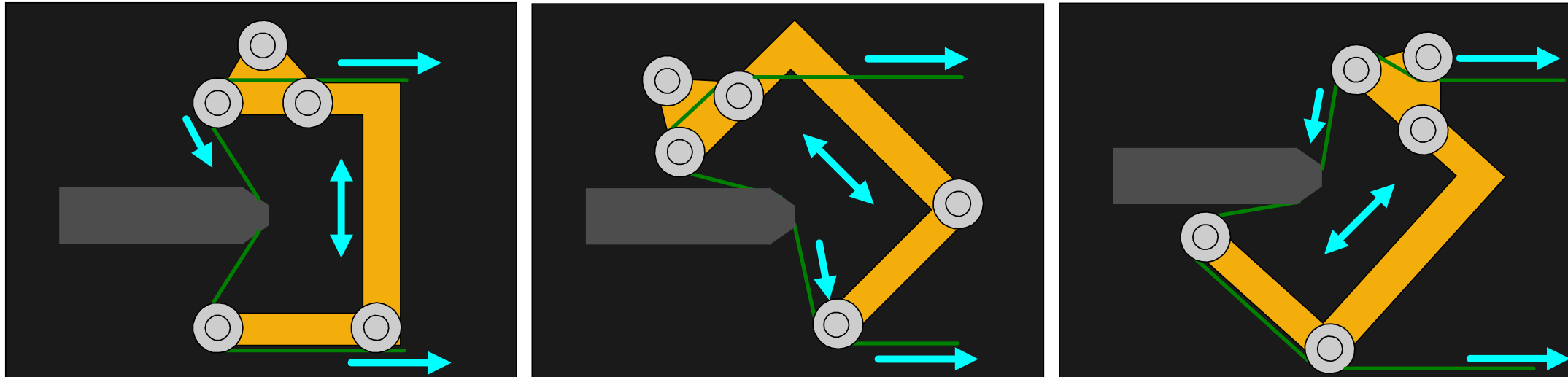
Polishing unit with angle



Notch polishing mechanism

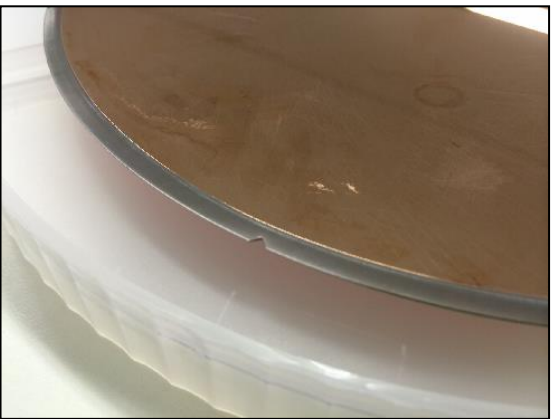
Unique polishing unit to process the wafer edge efficiently.

- Pull the polishing tape tight, which is 3mm width
- Tapes follow the notch shape

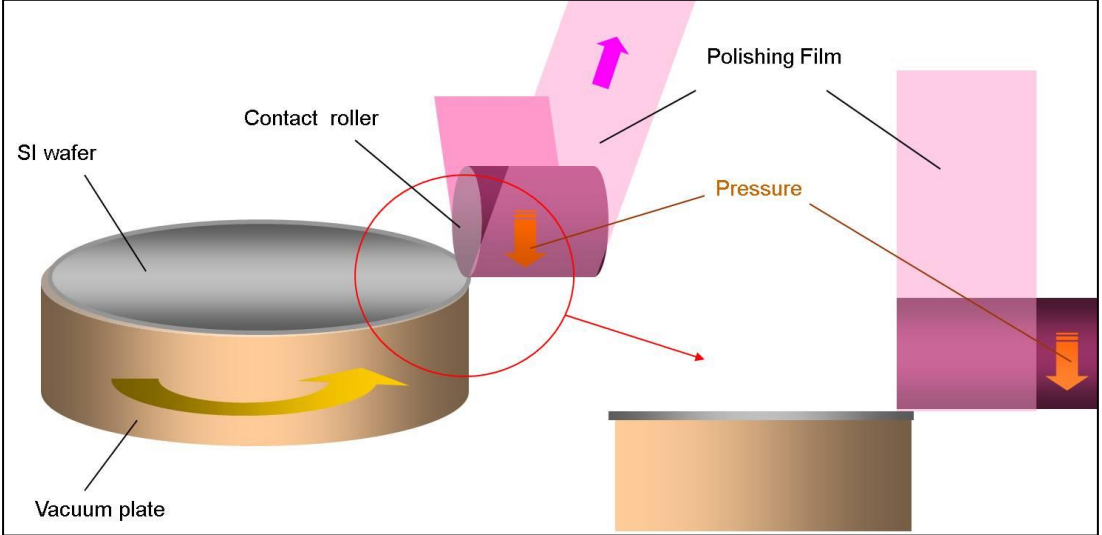


Edge trimming by polishing tape

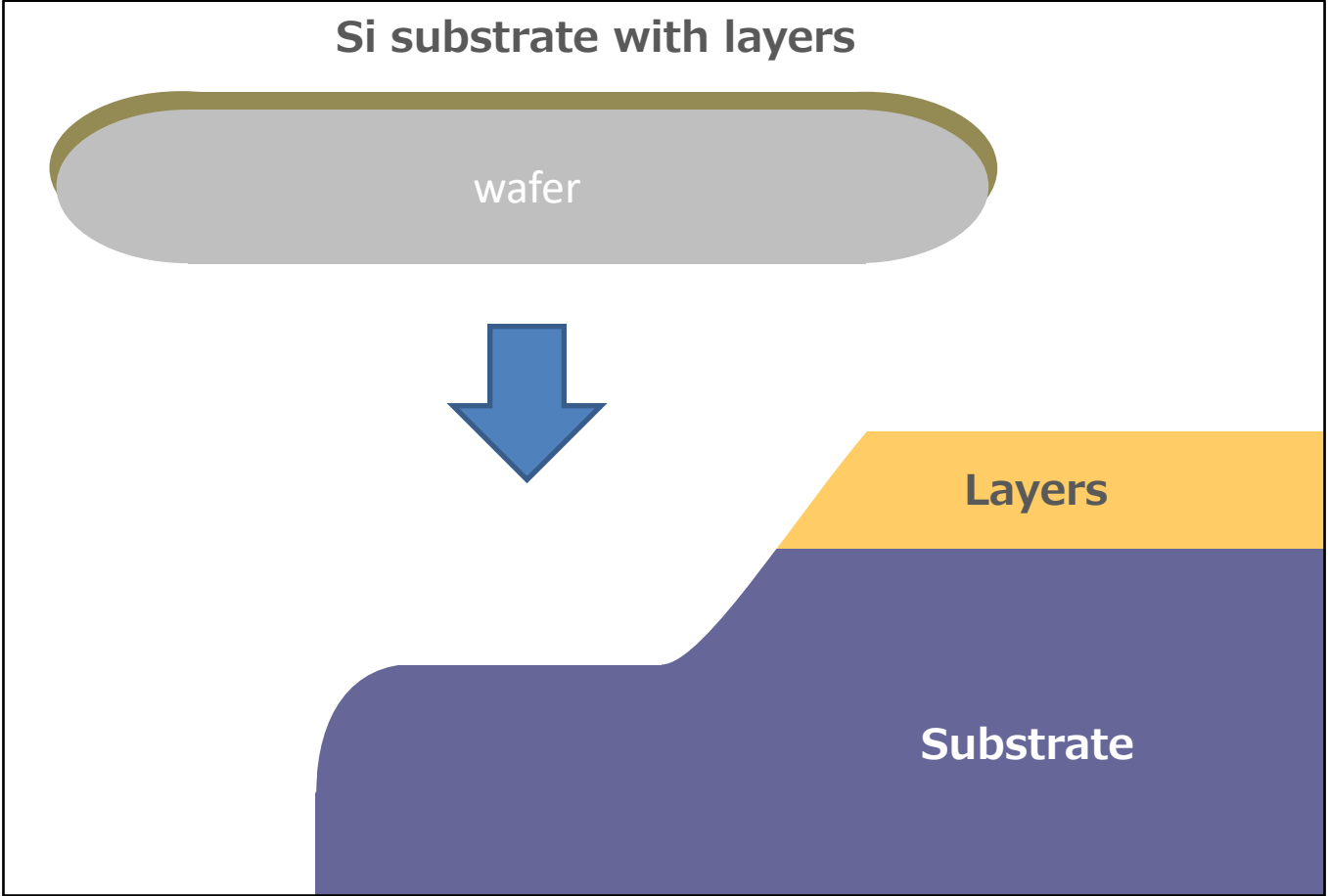
Polishing tape is capable to edge trim like grinders. Polishing tape can remove the layers with soft pressure and expose the surface the substrate Unlike edge grinder process, edge shape after polishing not 90 degrees, but a slope.



Wafer Appearance



An illustration of edge trimming by polishing tape

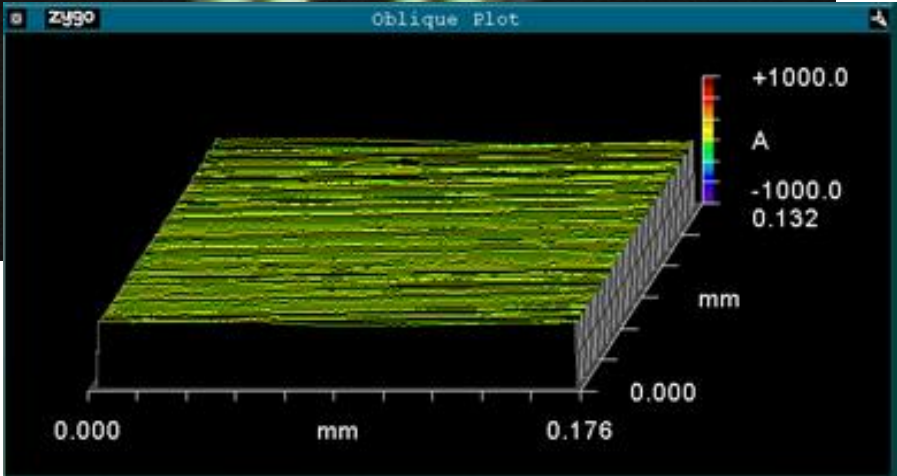
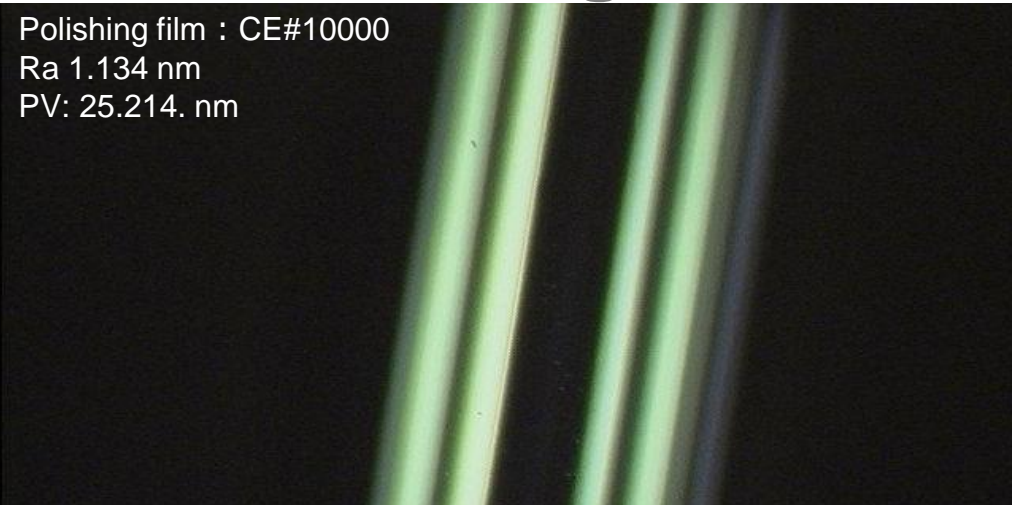


Edge shape after edge trimming

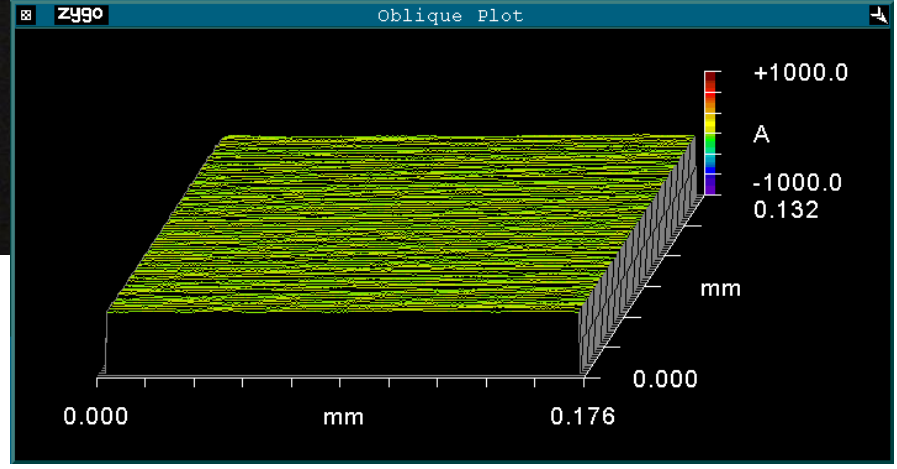
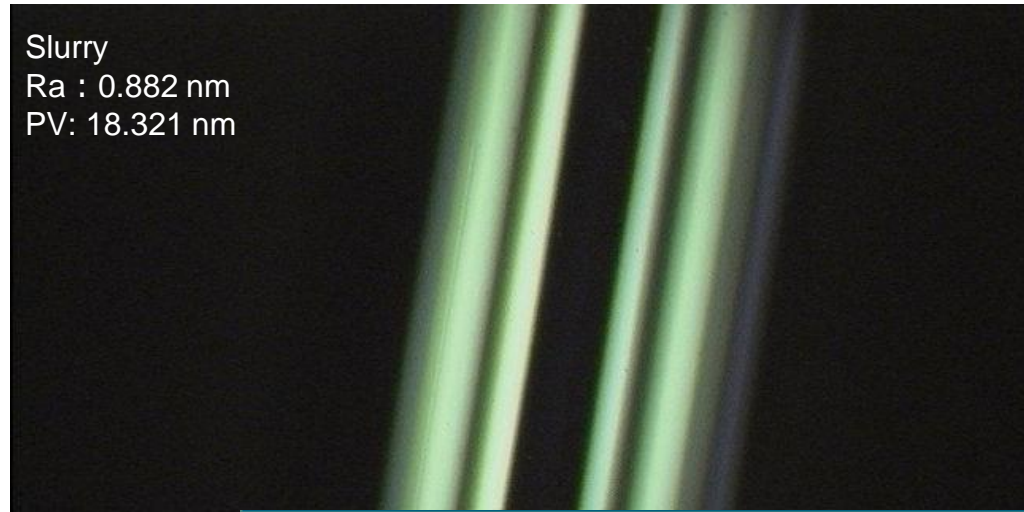
Slurry VS Polishing films

Polishing film is able to achieve almost as roughness as slurry.

Polishing film



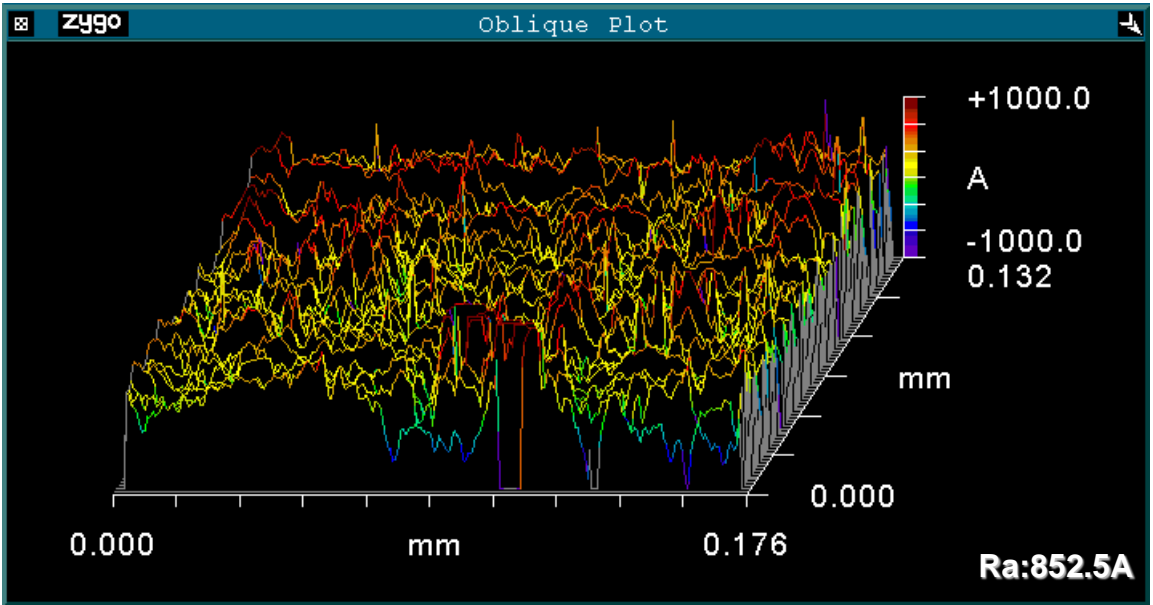
Slurry



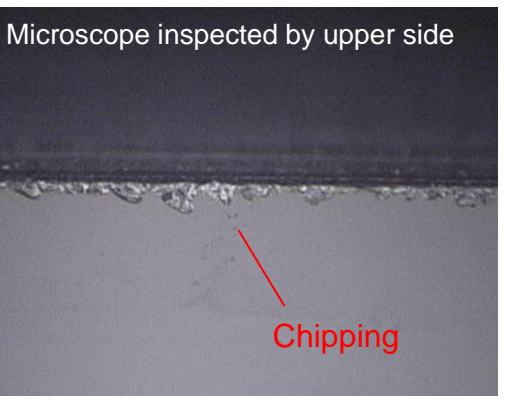
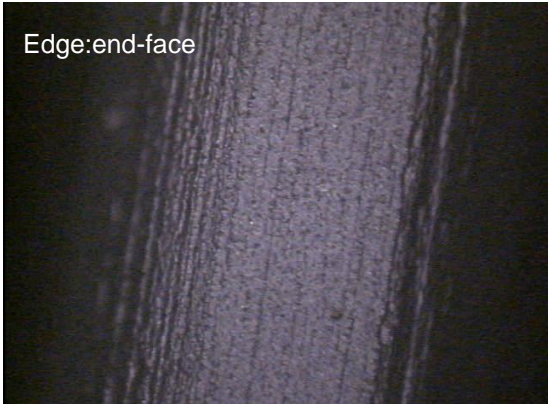
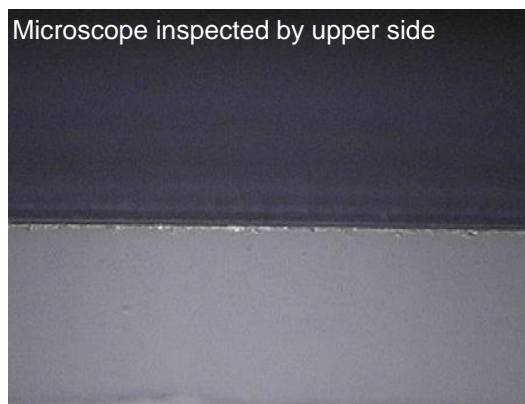
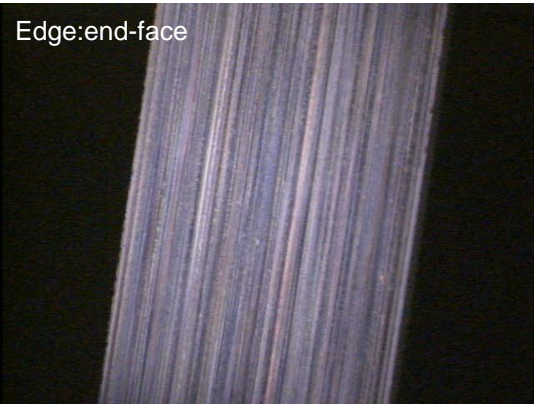
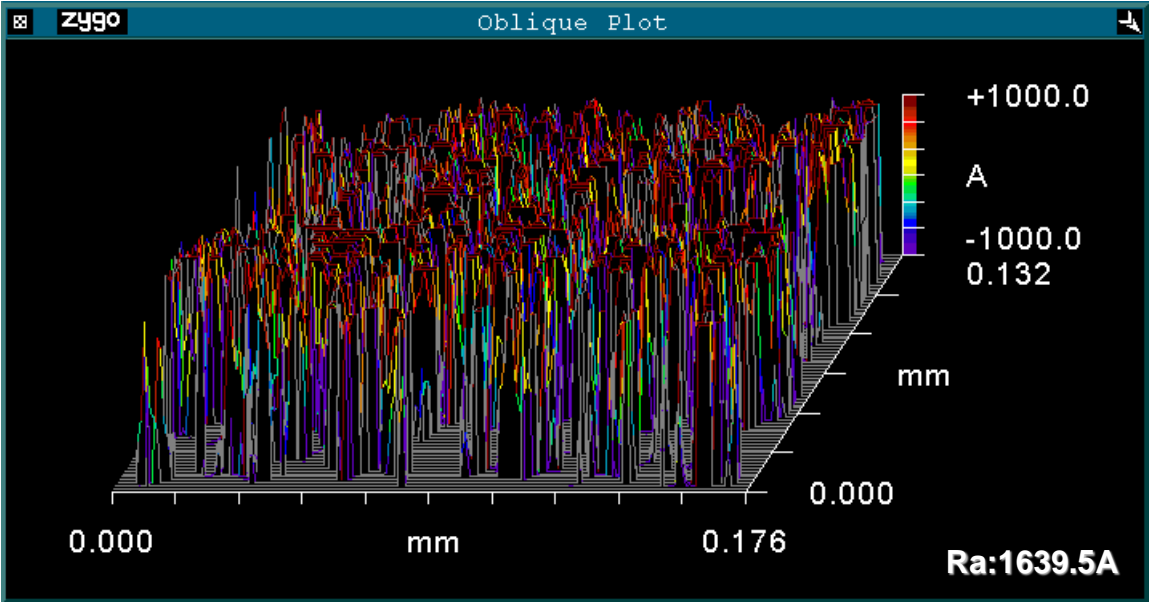
Edge Grinder VS Polishing films

Polishing films causes less crack than edge grinder

Polishing film



Edge grinder



characteristics (Wrap up the general comparison)

- Change roughness and shapes
- Softer pressure than the grinder
- Less chipping and crack than edge grinder
- No loading

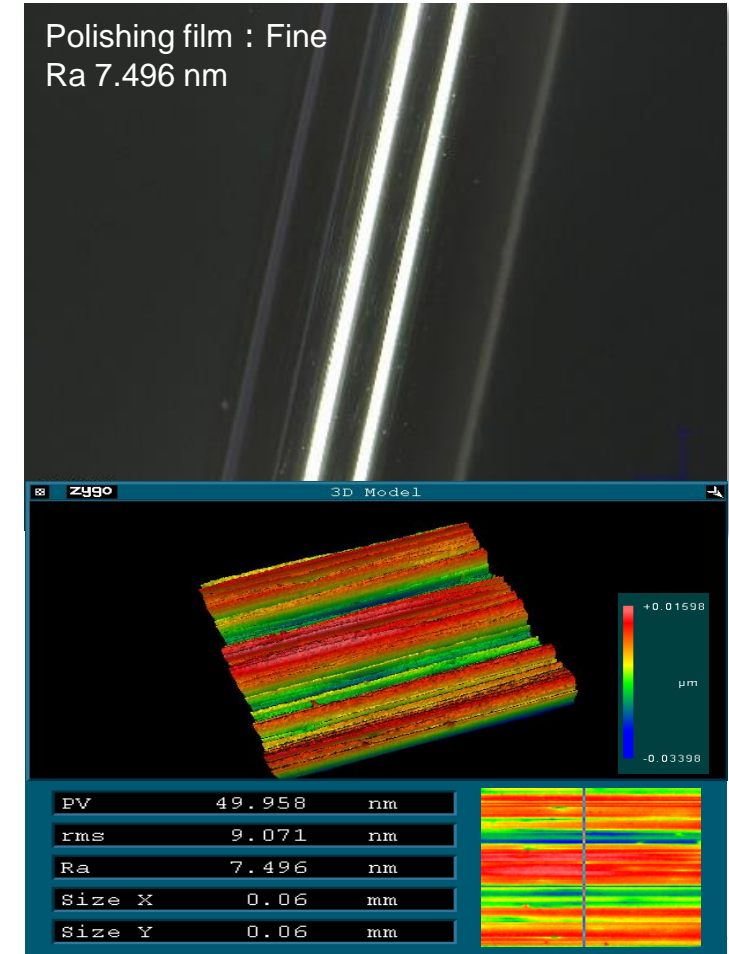
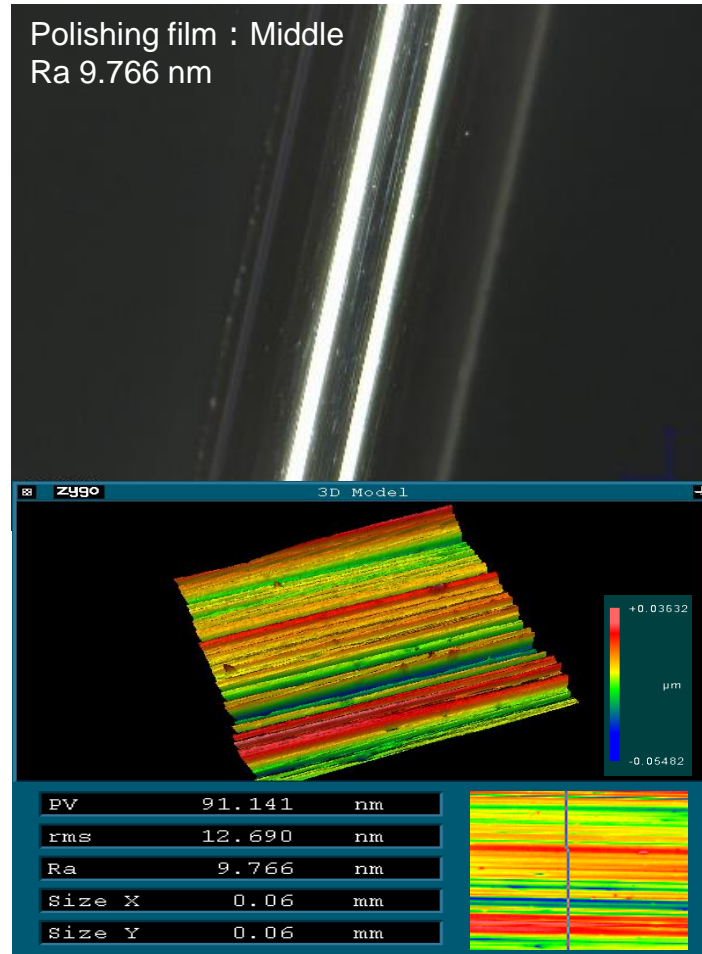
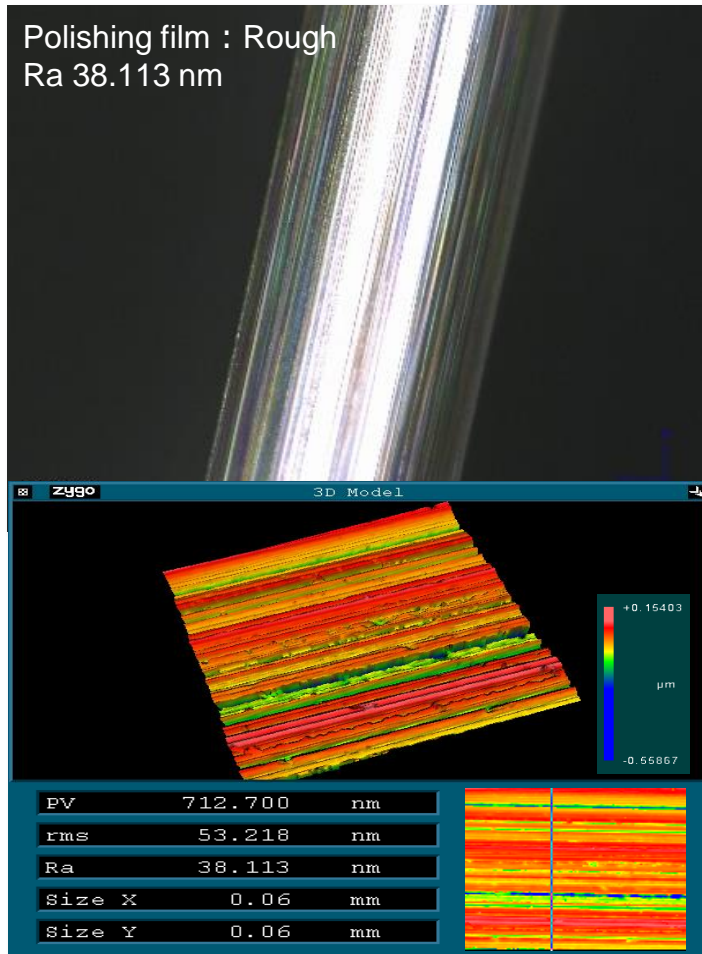
Application

- Polish the variety of substrates and layer : SiC, GaN, Oxide layers, metal layers
- Cleaning the edge contaminated by their process
- Remove the only layers, especially SiO₂
- Remove the slit of GaN-on-Si
- Remove the edge exclusion before bonding

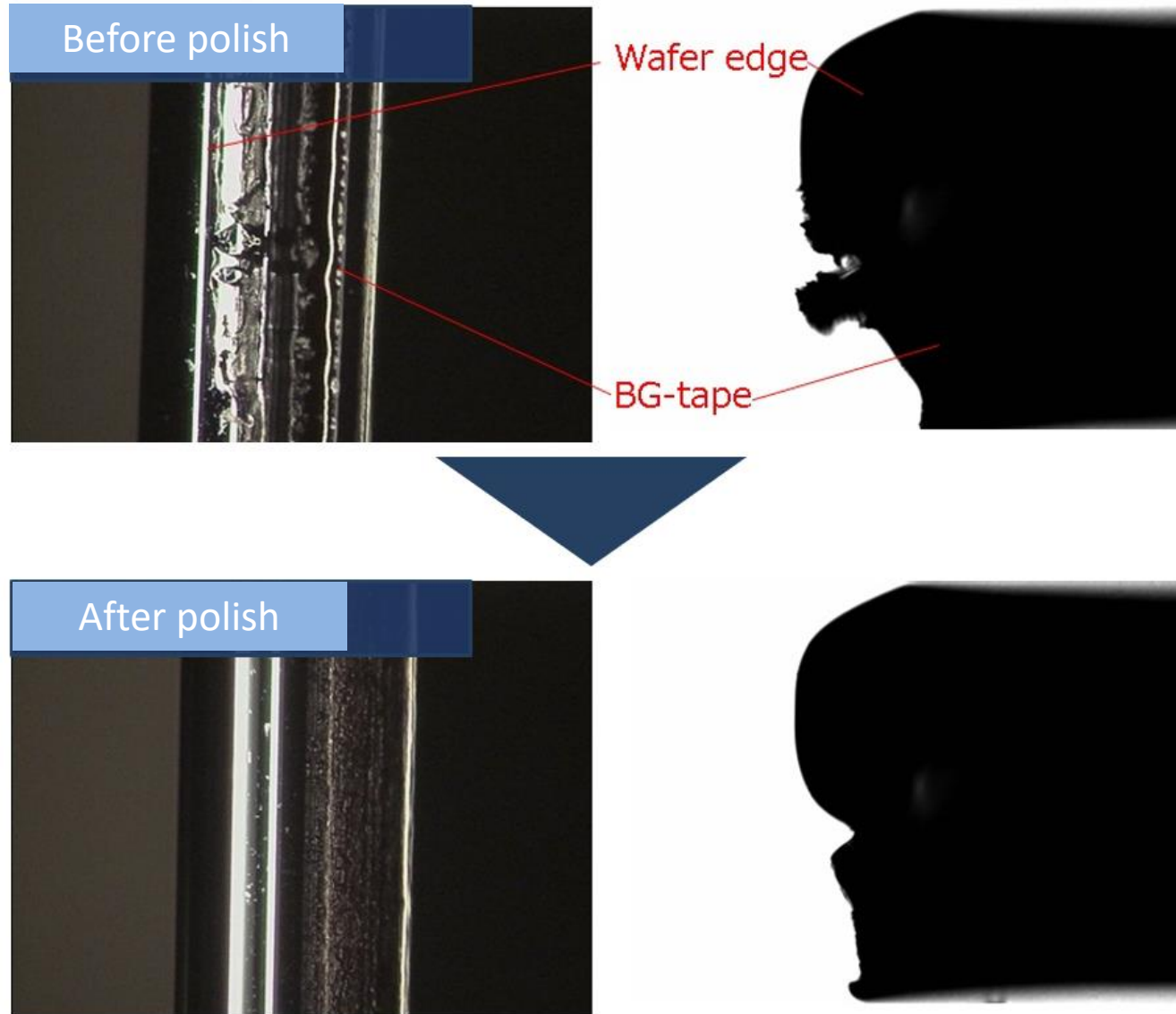
Application: Adaptability to various materials

Adaptable to various materials according to soft pressure and mechanical polish: Si, Ge, SiC, GaN, InP, GaAs,, Lithium tantalate, Lithium Nitride, Taiko. Because of loading-free feature of polishing films, we can also polish: Oxide layer, Nitride layer, various metal layers, fully developed wafers

In LT/LN substrate maker, polishing tape is adopted as a final polish instead of slurry

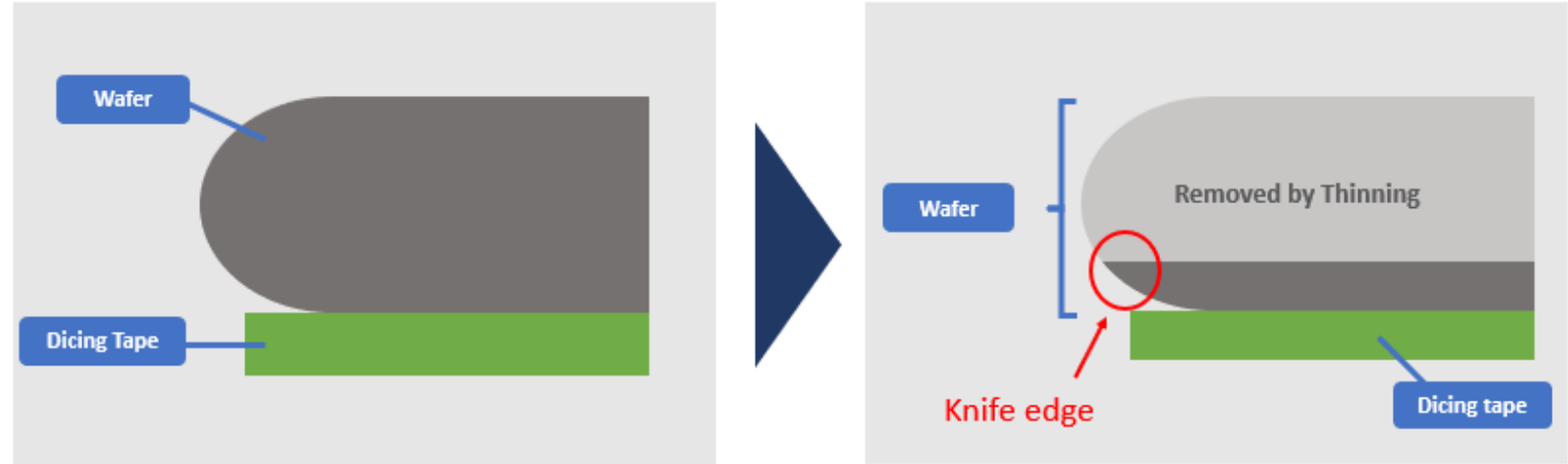


Application: Remove adhesive residue

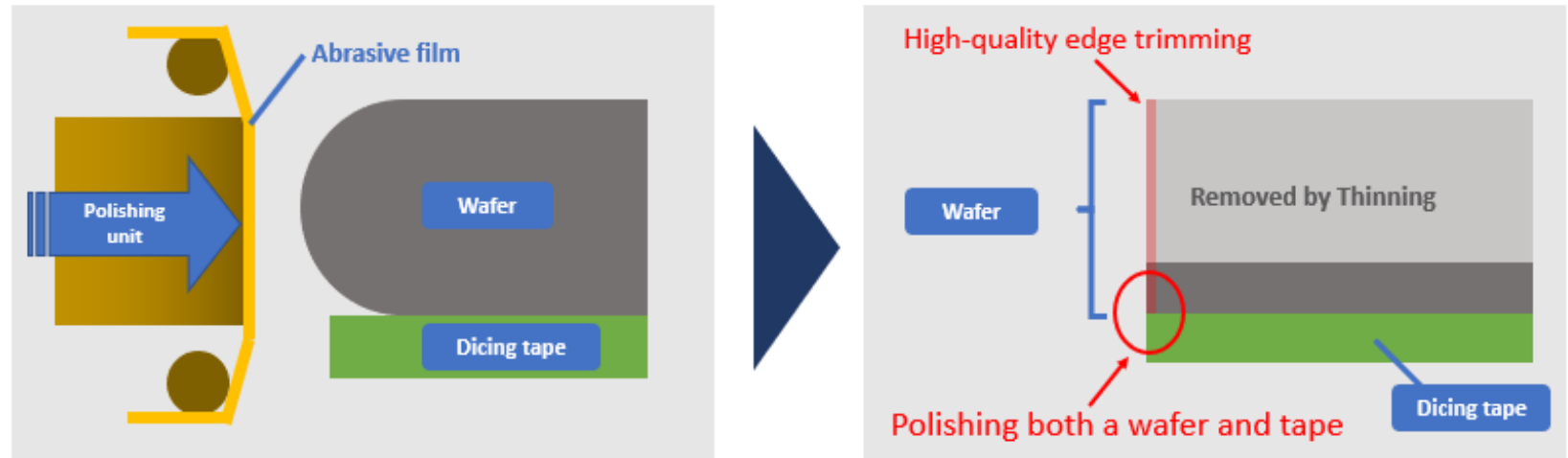


Application : BG tape removal by polishing

- In the thinning process, knife edge has the possibility that makes wafers chipping or broken because of strong pressure on the grind process.
- Polish both wafers and BG tape at the same time. Possible to make the trimmed edge shape., which prevent the chipping or breaking in backgrind process.



Mipox edge polish process



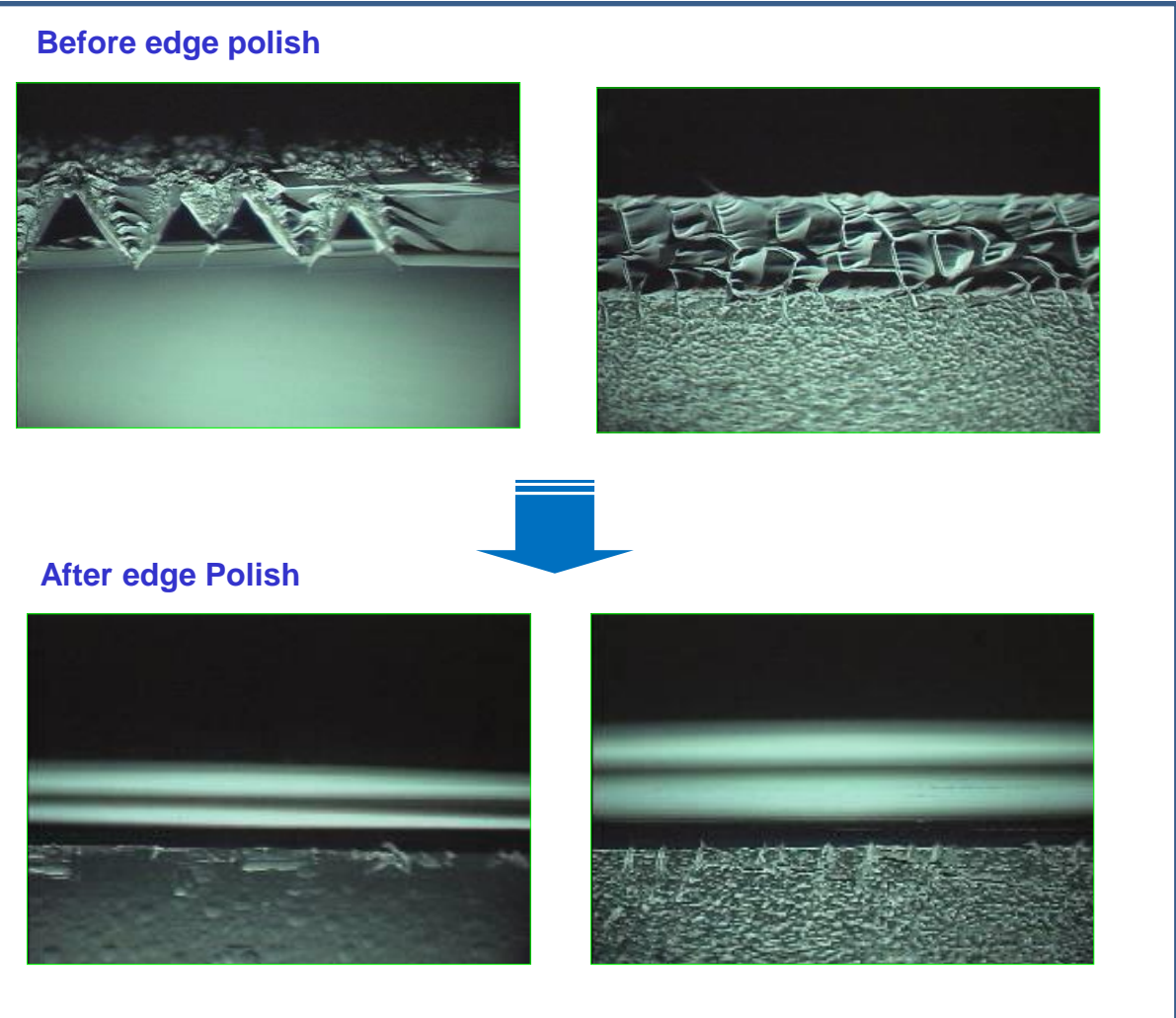
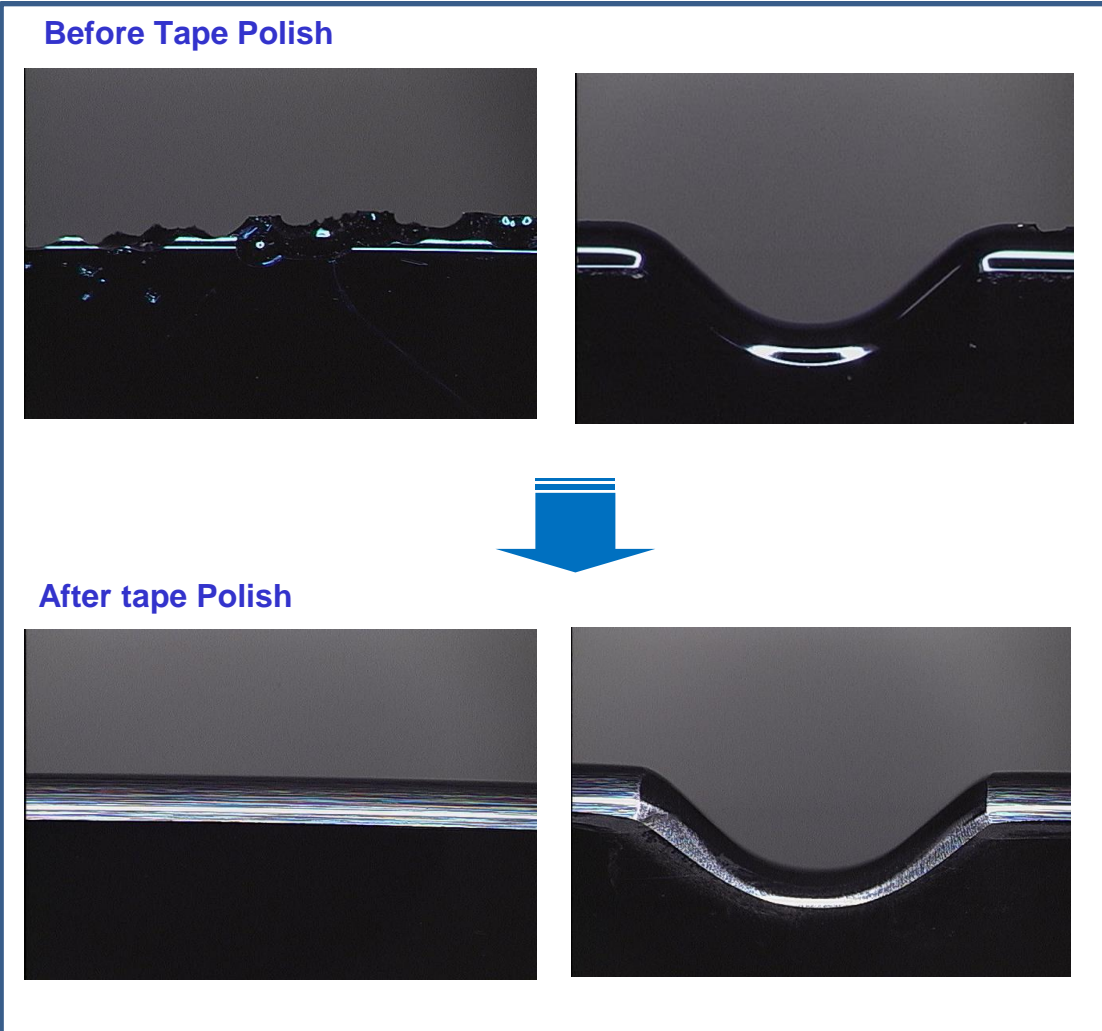
Application: Oxide layer removal

Alternative way of chemical (hydrofluoric acid). Basically, to remove the LTO layer around the edge is done by chemical material. And need to protect the surface of wafer. Polishing films can remove whole oxide layer around the edge. Comparing chemical process, this is environmental-friendly and don't need the process to protect oxide layer

Bef				
Edge polish				
Edge polish + Edge trimming				

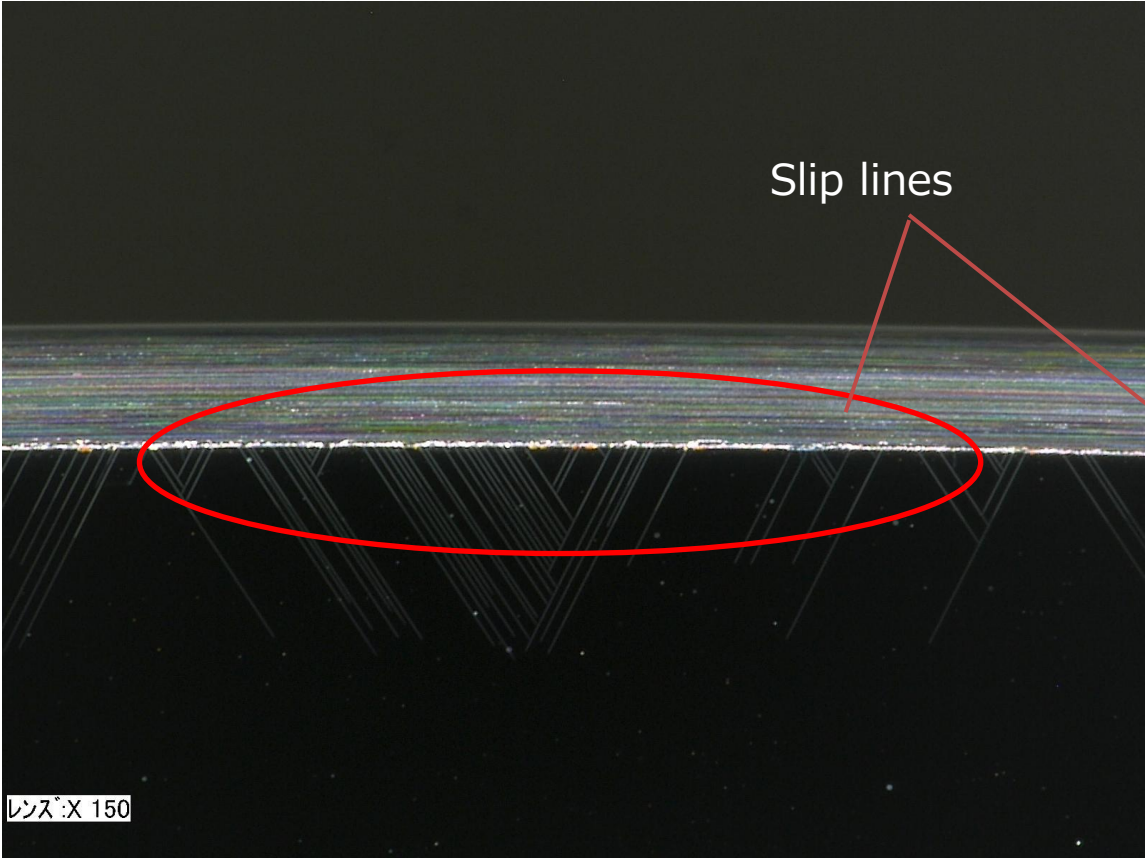
Application: Reclaim wafer

In Japan, Edgepolisher is installed in silicon reclaim wafer companies to remove the accumulated contamination around edge area. **Edge polisher is also capable to the reclaim process for compound semiconductor.**

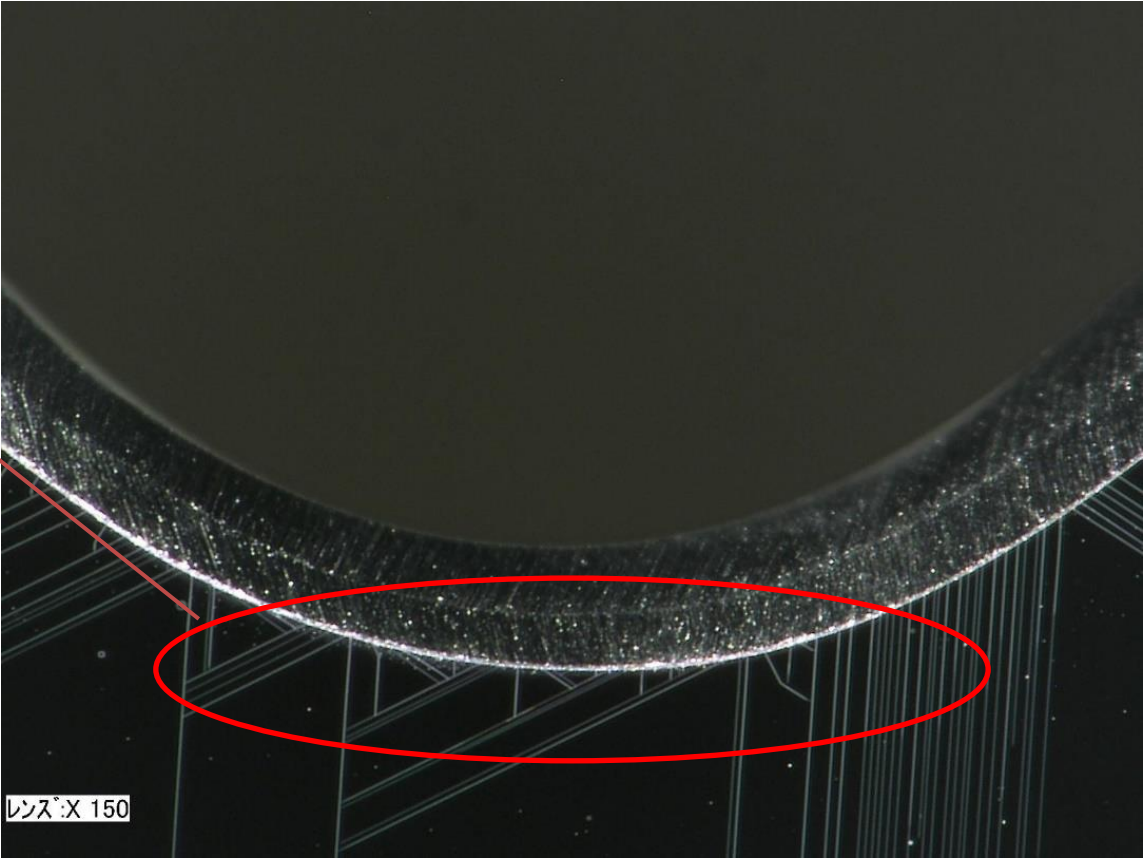


Application: GaN-on-Si substrate

After the epi GaN layer growth, silicon wafers have the crack called slip line. The slip line appears around the edge area and expand toward the center of the wafers. Slip line makes the device brittle and cause electroical damage to the chips.



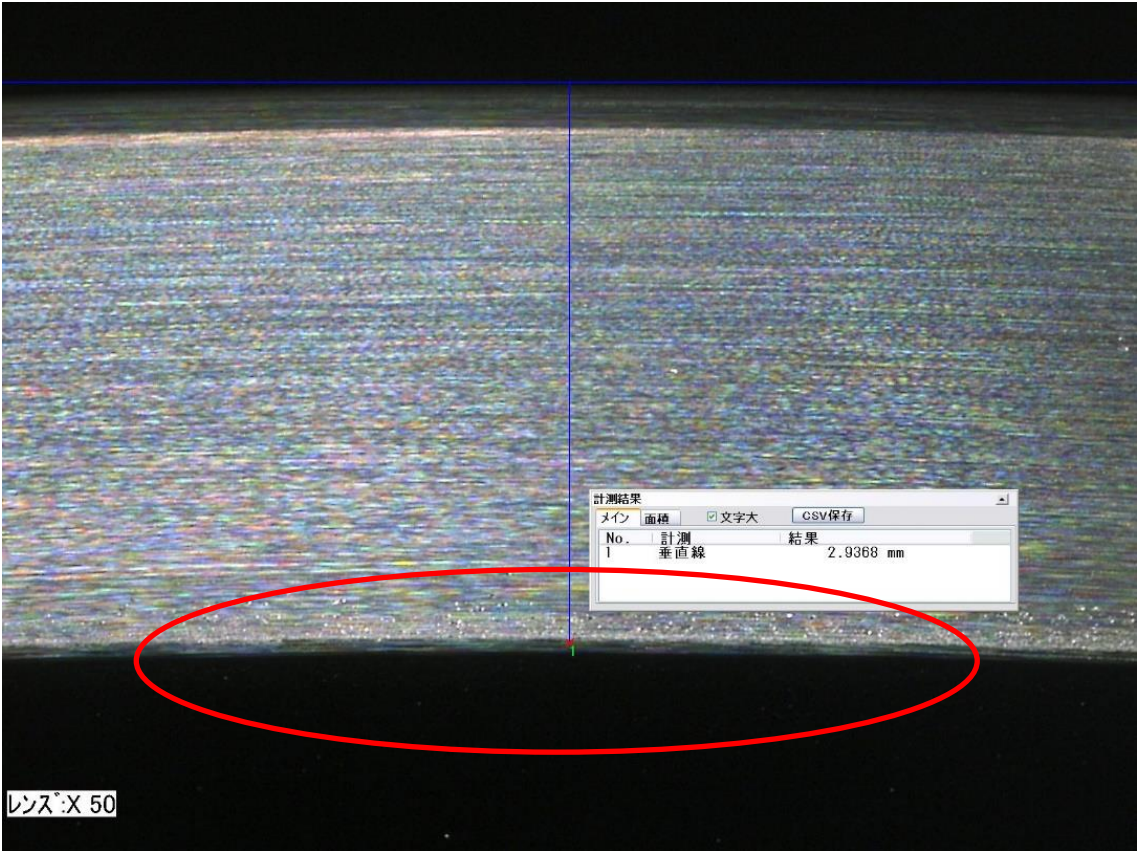
Edge area: Microscope inspection



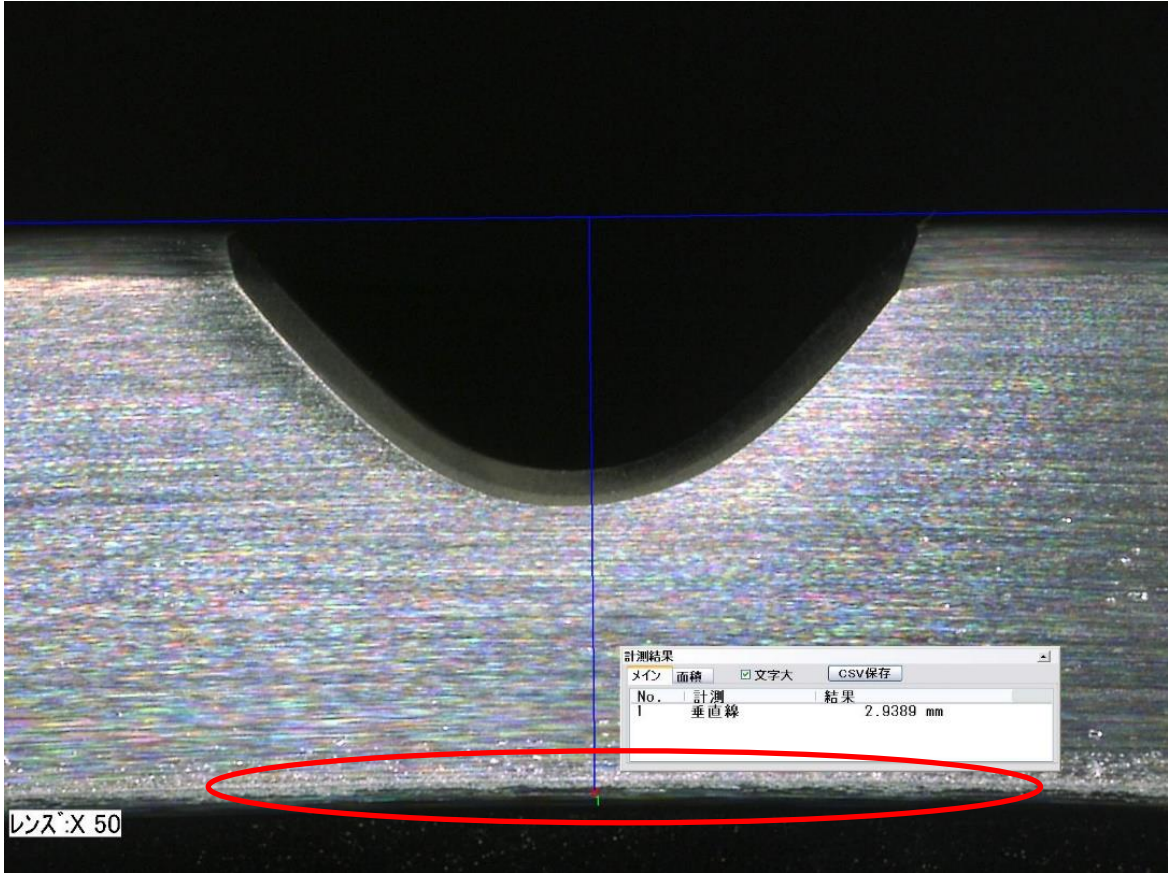
Notch area: Microscope inspection

Application: GaN-on-Si substrate

Polishing tape is able to remove the slip lines without growing them. The slip line tends to be generated around the edge area. To change the edge area from not-processed status to the mirror makes wafer robust and less generates the slip lines again



Edge area: Microscope inspection after polish



Notch area: Microscope inspection after polish



Brief service lineup of Mipox

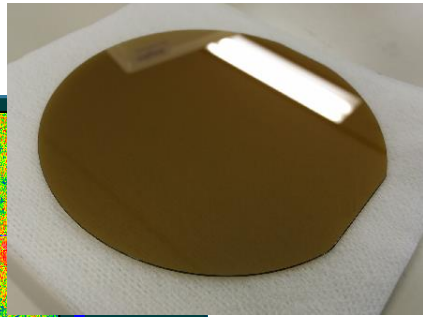
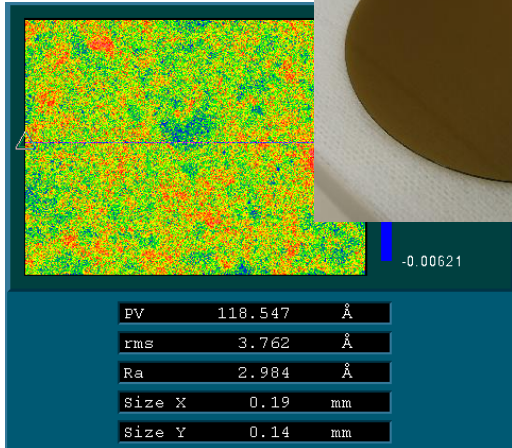
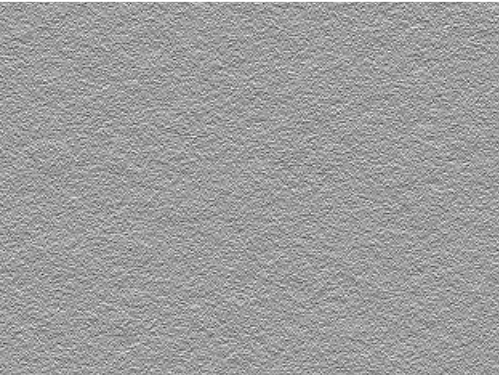
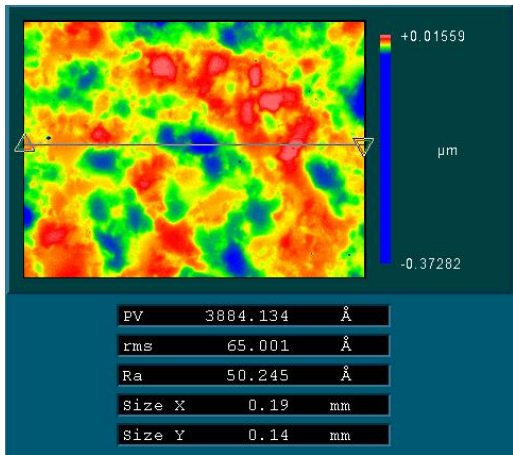
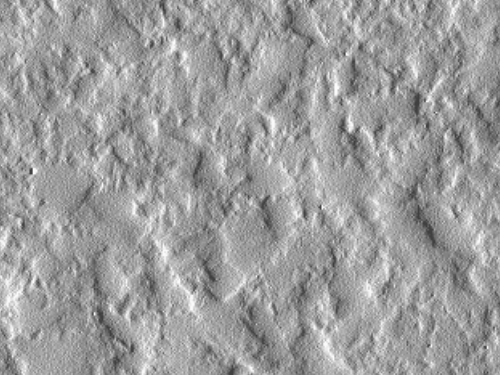
Surface polishing/CMP

We provide advanced surface polishing and CMP service. We can polish various materials: Substrate, semiconductor layers, conductor layers, dielectric layers. We also have the experience to make slurry and ceramic, unusual layer in R&D are acceptable.



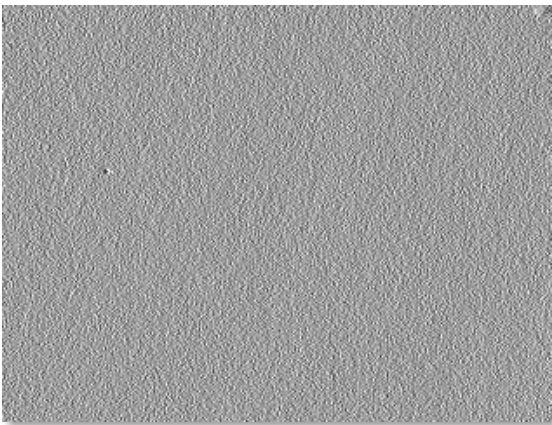
	Track record
Substrate	Si, SiC, GaAs, GaP, InP, Glass, Diamond(chip)
Dielectric/semi conductor-layer	SiN,SiO2,
Metal layer	Cu, Al, Au, Pt, Mo, Ni, Ag, Ti, W, Fe-Ni, Ru, Ni-P
Electro-ceramics	SiC, SiN, PZT, AlN, Sappahire

Poly-SiC substrate

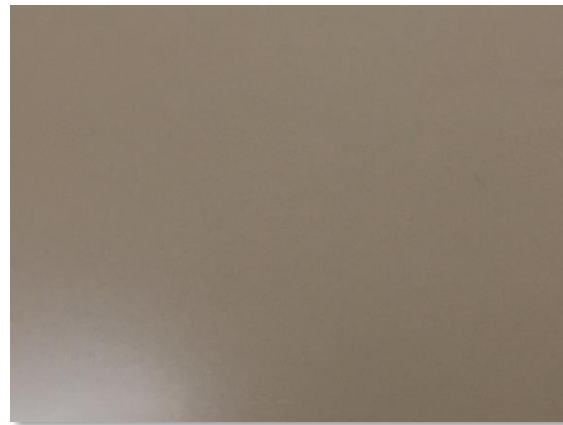


Wafer bonding

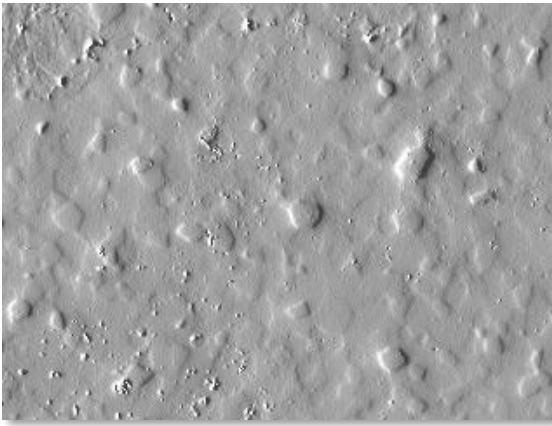
We have Room Temperature Bonding tool. To combine with Mipox polishing skills, we achieve top-notch bonding. Room Temperature Bonding Feature: Permanent bonding, under low temperature and ultra vacuum, bonding between different materials including compound semiconductor ceramics and metal layer.



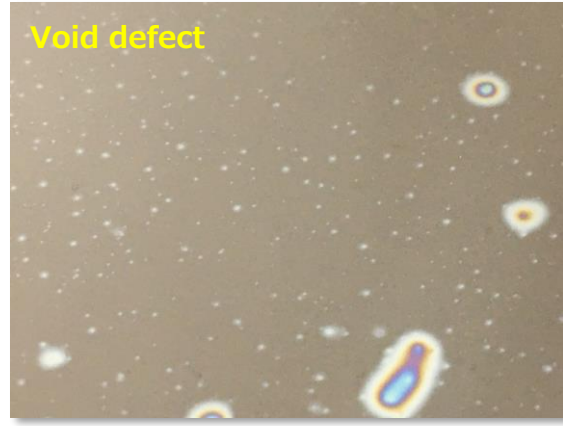
Mipox polishing pre treatment



Mipox bonding Quality



Others pre treatment



Void defect

Others bonding Quality



Thank you for your attention