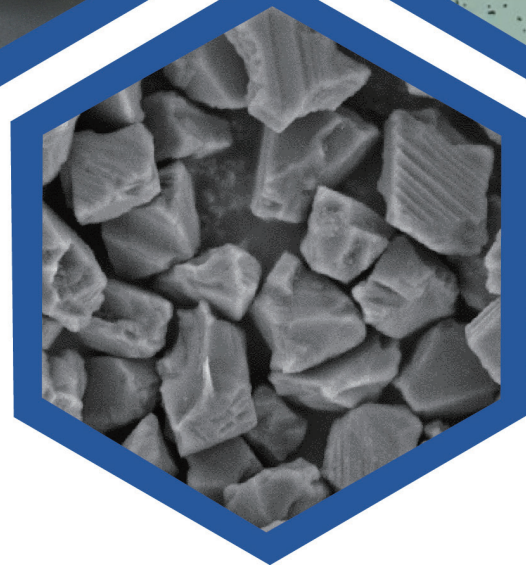
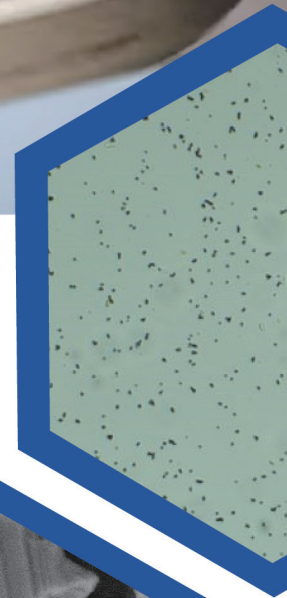





SOLUTION FOR LAPPING/ PRECISION POLISHING

World-leading diamond slurries



-  *HAPD / HSPD*
-  *HAPH / HSPH*
-  *HAM / HSM*

CREATE ENDLESS POSSIBILITIES WITH THE POWER OF DIAMOND



Qual Diamond
Hi-tech Corporation

ABOUT THE COMPANY

With almost 30 years of experience in R&D and production of industrial synthetic diamonds and diamond tools, Qual Diamond specializes in producing and developing diamond powder, diamond slurry and suspension, CVD diamond tools, PCD diamond tools, EF Drill bits and more.

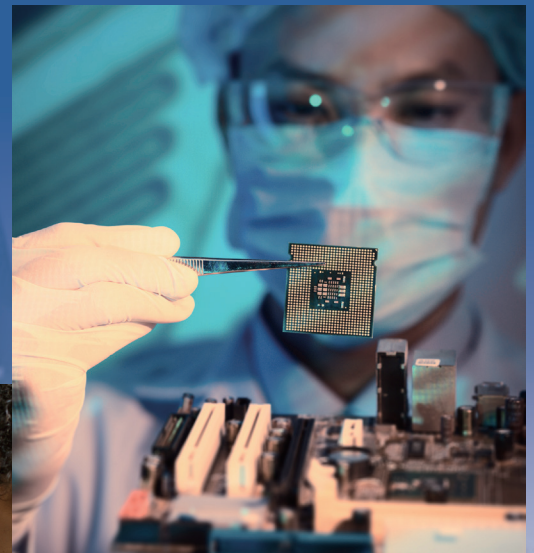
Our company's success derives from collaborative teamwork and strong technical support. We control every step of the process from procuring raw materials to producing finished products and follow strict standards of the ISO 9001 quality control system and ISO 14001 environmental system. All raw materials are eco-friendly and recyclable. To guarantee consistent quality, we use advanced state of the art inspection equipments to determine particle shape and distribution, elemental analysis, and impurity detection. Our dedicated team is ready to assist and offer the best solutions to meet the demands of various industries, such as, aerospace, automotive, electronics, medical, advanced ceramics, and glass. With our innovative and technical approach, we hope to help you develop a bright future and create endless possibilities with the power of diamonds.

OUR PHILOSOPHY:

"Quality is our life, customers are Our Priority."

OUR MISSION:

Qual Diamond innovates best in class manufacturing and processing solutions for advanced industries.



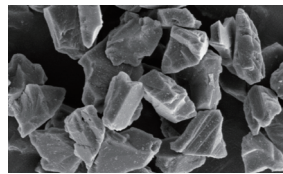
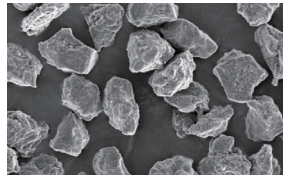


HAPD/HSPD Diamond Slurry

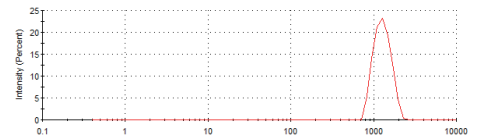
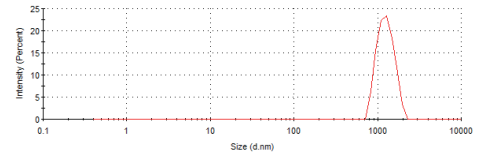
Hydroqual Advanced Detonated Polycrystalline Diamond Slurry
 Hydroqual Standard Detonated Polycrystalline Diamond Slurry



HAPD in different size of containers



SEM



Size Distribution

INTRODUCTION:

Qual Diamond Hydroqual Detonated Polycrystalline Diamond Slurry is hydro-based formulation. The slurries are made with detonated polycrystalline diamond particles dispersed in the water-based liquids. The unique surface modification technology prevents the agglomeration of diamond particles. Available sizes range from submicron to 10µm. They are widely used for lapping and precision polishing of different materials such as silicon chips, optical devices, metallic works, etc.

FEATURES:

- ◆ The rough polycrystalline diamond particle surface has numerous contact points between diamond particles and the work piece, providing high material removal rates
- ◆ Its compressive strength and impact strength are far below monocrystalline diamond. During the lapping process, the applied pressure breaks the polycrystalline particles exposing new sharp cutting edges
- ◆ As it breaks down in its original shape, allowing for finer finishes
- ◆ Polycrystalline does not have cleavage planes thus cannot splinter like monocrystalline diamonds. Thus, it will not sub-surface deformation
- ◆ Ideal for high performance lapping and polishing
- ◆ Tightly controlled particle size distribution and oversized particles
- ◆ Well stabilized slurries increases process stability
- ◆ All the ingredients are environmentally-friendly decreasing the disposal cost
- ◆ Easy to clean after lapping/polishing
- ◆ Qual Diamond 's innovative formulation can sustain -20°C to 50°C environment

Size	Grit Distribution			PH value
	D10,µm	D50,µm	D99,µm	
0-0.25	0.1	0.1	0.4	7.5-9.0
0-0.5	0.1	0.3	0.8	7.5-9.0
0.5-1	0.2	0.4	1.5	7.5-9.0
1-2	1.0	1.2	2.9	7.5-9.0
1-3	1.0	2.0	3.9	7.5-9.0
2-3	1.5	2.5	4.0	7.5-9.0
3-5	3.0	4.0	6.8	7.5-9.0
5-7	4.0	6.1	8.5	7.5-9.0
6-12	5.5	8.8	15.5	7.5-9.0
7-10	6	8.9	12.8	7.5-9.0
Available Concentration:	1g/l, 2g/l, 5g/l, 10g/l, 25g/l, 50g/l			
Available Viscosity:	A 100-150cpm, B 200-300cpm, C 500-800cpm, D over1000cpm			
Available Package:	250ml 500m 1L 1G			

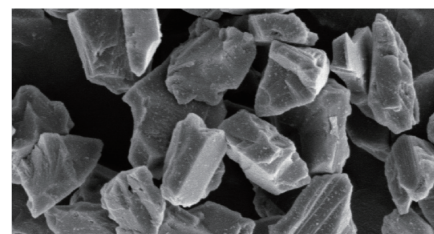


HAPH/HSPH Diamond Slurry

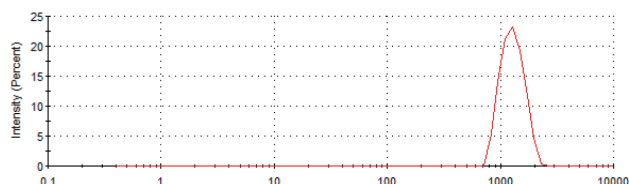
HAPH: Hydroqual Advanced High-Pressure High-Temperature Polycrystalline Diamond Slurry
 HSPH: Hydroqual Standard High-Pressure High-Temperature Polycrystalline Diamond Slurry



HAPH in different size of containers



SEM



Size distribution

INTRODUCTION:

Qual Diamond's High-Pressure High-Temperature Polycrystalline Diamond Slurry is a hydro-Pressure formulation. The slurries are made with High-Temperature High-based Polycrystalline Diamond particles dispersed in water-based liquids. The unique surface modification technology prevents the agglomeration of diamond particles. Sizes are available from 1µm to 60µm. The number of contact points, edges and fine finishing results lie between monocrystalline and detonated polycrystalline diamond slurries.

FEATURES:

- ◆ Multi-micro cutting edges provide fast material removal rates
- ◆ Particle shape consistency ensures uniform surface finish
- ◆ Superior friability leads to easy break-down of the particles exposing new sharp cutting edges
- ◆ Tightly controlled particle size distribution and oversized particles
- ◆ Well stabilized slurry increases process stability
- ◆ Adopt 99% biodegradable materials and can substantially lower the disposal and recycling cost
- ◆ Easy to clean after lapping/polishing
- ◆ Qual Diamond's innovative formulation can sustain -20°C to 50°C environment

Size	Grit Distribution			PH value
	D10,µm	D50,µm	D99,µm	
0-0.2	0.1	0.13	0.35	7.5-9.0
0-0.25	0.1	0.16	0.4	7.5-9.0
0-0.5	0.1	0.33	0.64	7.5-9.0
0.5-1	0.45	0.78	1.65	7.5-9.0
1-2	0.8	1.3	3.1	7.5-9.0
1-3	0.92	1.23	3.5	7.5-9.0
2-3	1.1	2.6	4.9	7.5-9.0
3-5	2.2	3	5.1	7.5-9.0
5-7	4.1	5.6	9.5	7.5-9.0
6-12	4.8	8.9	13.7	7.5-9.0
7-10	6.3	8.5	14	7.5-9.0
10-20	11.5	14.6	22.7	7.5-9.0
20-30	18.9	24.6	39.4	7.5-9.0
30-40	26.3	33.4	50.9	7.5-9.0
40-50	31.6	40	60.4	7.5-9.0
Available Concentration:	1g/l, 2g/l, 5g/l, 10g/l, 25g/l, 50g/l			
Available Viscosity:	A 100-150cpm, B 200-300cpm, C 500-800cpm, D over1000cpm			
Available Package:	250ml 500m 1L 1G			



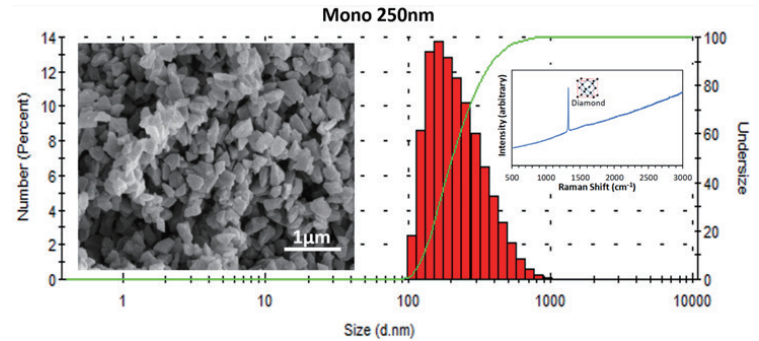
HAM/HSM Diamond Slurry

Hydroqual Advanced High-Pressure High-Temperature Monocrystalline Diamond Slurry

Hydroqual Standard High-Pressure High-Temperature Monocrystalline Diamond Slurry



HAM/HSM in different size of containers



SEM

Size distribution

INTRODUCTION:

Qual Diamond's High-Pressure High-Temperature Monocrystalline Diamond Slurry is hydro-based formulation. The slurries are made with High-Pressure High-Temperature Monocrystalline Diamond particles dispersed in the water-based liquids. The water-soluble slurry does not dry up when exposed to air and is a perfect alternative product to oil-based polishing fluids. The unique surface modification technology prevents the agglomeration of diamond particles. The product is ideal for polishing of super hard materials, such as, tungsten carbide, sapphire, ruby, etc. The available sizes range from 0.2µm to 60µm.

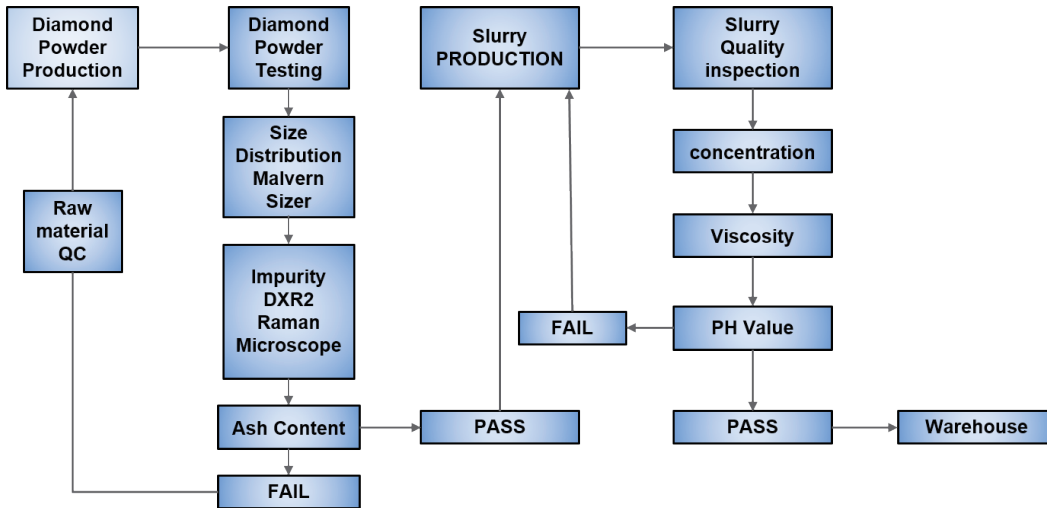
FEATURES:

- ◆ Monocrystalline diamond provides a cost effective means for good stock removal and finish
- ◆ It has slightly irregular shape with multiple cutting edges
- ◆ Sharp particles with higher toughness ensuring clean and efficient cutting
- ◆ It is recommended for general applications where polycrystalline features are not required
- ◆ Widely used for lapping and polishing applications
- ◆ High-purity (99-99.5%) and carefully selected diamonds effectively improve efficiency and output
- ◆ Tightly controlled particle size distribution and oversized particles
- ◆ Well stabilized slurry increases process stability
- ◆ All the ingredients are environmentally-friendly decreasing the disposal cost
- ◆ Easy to clean after lapping/polishing
- ◆ Qual Diamond's innovative formulation can sustain -20°C to 50°C environment

Size	Grit Distribution			PH value
	D10,µm	D50,µm	D99,µm	
0-0.2	0.1	0.16	0.28	7.5-9.0
0-0.25	0.1	0.15	0.4	7.5-9.0
0-0.5	0.15	0.2	0.45	7.5-9.0
0.5-1	0.25	0.42	1.35	7.5-9.0
1-2	0.71	1.11	2.06	7.5-9.0
1-3	1.2	1.7	3.2	7.5-9.0
2-3	1.5	1.95	3	7.5-9.0
3-5	2.5	3.2	5.1	7.5-9.0
5-7	3.9	5.3	9.1	7.5-9.0
4-6	3.1	5.2	7.3	7.5-9.0
6-12	5.2	8.4	13.8	7.5-9.0
7-10	5.2	7.1	12.4	7.5-9.0
10-20	8.5	16.2	22.5	7.5-9.0
20-30	17.2	24	42	7.5-9.0
30-40	23.2	31.1	51.3	7.5-9.0
40-50	28.4	47.5	61.7	7.5-9.0
Available Concentration:	1g/l, 2g/l, 5g/l, 10g/l, 25g/l, 50g/l			
Available Viscosity:	A 100-150cpm, B 200-300cpm, C 500-800cpm, D over1000cpm			
Available Package:	250ml 500m 1L 1G			

QUALITY CONTROL

DIAMOND POWDER & SLURRY QUALITY PROCEDURE DIAGRAM



- ◆ Our products are made in the USA
- ◆ We are certified and strictly follow ISO 9001:2015 requirements
- ◆ Qual Diamond products pass strict multi-point quality inspection process to ensure our products meet or exceed your expectations. Our multi point quality process parameters are critical for our products. In all our diamond tools we inspect
 - ◆ Tool material composition
 - ◆ Qual Diamond manufactures several types of machine tools from alloy steel tools coated with electroplated diamond to advanced PCD and CVD diamond tools. CVD and PCD diamond tools we inspected using our state-of-the-art laboratory cobalt content. The cobalt content is the main factor in very small diameter CVD diamond coated tools flexural toughness
 - ◆ Tolerance: Qual Diamond uses strict tolerance measurement standards; we inspect every tool to meet or exceed the tolerance threshold
 - ◆ Surface finish is an important quality parameter in diamond tools. The surface finish affects the quality of machining and quality of end product. We inspect each tools surface finish to eliminate the effects in manufacturing
 - ◆ Diamond coating distribution and quality. Diamond coating whether it is CVD coating or electroplated needs consistency and quality diamonds. Qual Diamond inspects all tools for consistent diamond coatings
 - ◆ Concentricity is important in cylindrical tools such as drill bits. Qual Diamond inspects each tools concentricity to meet or exceed the set standards



SOLUTION FOR SEMICONDUCTOR INDUSTRY

OVERVIEW:

Semiconductor technology has been growing rapidly due to new wafer manufacturing technologies, advances in simulation, MEMS, and Nano manufacturing. In the semiconductor industry, thinning of silicon wafers is carried out by fine grinding and polishing. Other electronics apparatus, such as, PCB manufacturing technology also have grown significantly while challenges in machining and thickness quality remains the main concern in the industry.

These parameters are very important in achieving the desired performance from the diamond slurry for

any industry. Qual Diamond is equipped with a new methodology in synthesizing diamond slurries that match or exceed these criterions. Our **Hydroqual Mono slurry** or **Hydroqual Poly D** slurry can be used in each stage of the polishing process for electronic and semiconductor applications.

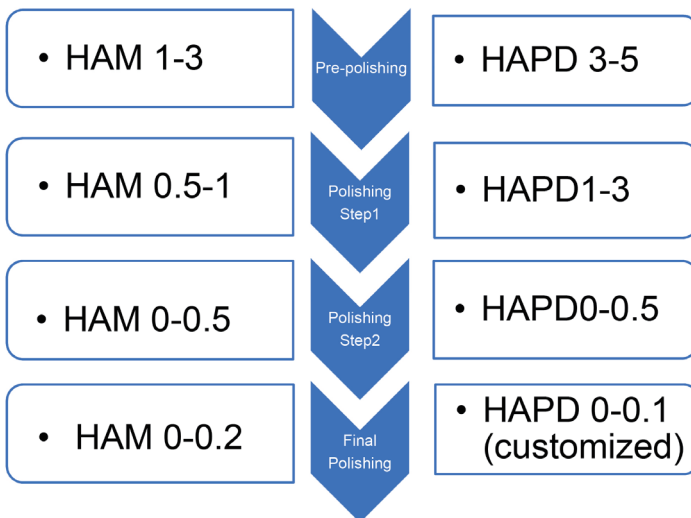
In silicon wafer thinning size distribution of diamond is very important to have a consistent edge-to-edge flatness and a good aspect ratio. Qual Diamond can customize diamond slurries based on these requirements using our high quality, and very narrow size distribution diamond powders.

Qual Diamond slurries are stable, very narrow size distribution and are environmentally friendly. Our slurries can be used in any machines with automatic dosing or manual spray.

SOLUTION:

Monocrystalline Diamond
Size (μm)

Polycrystalline Diamond
Size (μm)

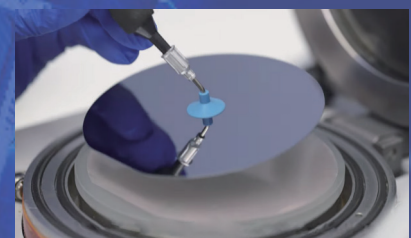
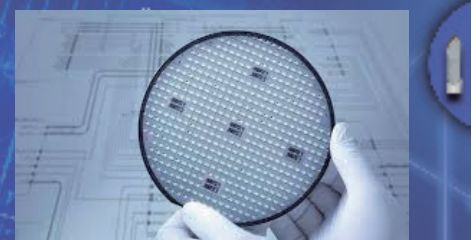


APPLICATION:

Industries	Materials	Hydroqual Mono Diamond Slurry	Hydroqual Poly D Diamond Slurry
Semi-conductor	Al ₂ O ₃	✓	✓
	SiO ₂	✓	✓
	Cadmium telluride	✓	✓
	Gallium Arsenide	✓	✓
	Gallium Phosphide	✓	✓
	Indium Phosphide	✓	✓
	lithium Niobate	✓	✓

BENEFIT:

- * Higher stock removal rate as compared to other slurries. More than 10 fold reported
- * Reduced number of process steps
- * Lower slurry consumption compared to other abrasive slurries
- * Polycrystalline slurries perform better than monocrystalline in silicon wafers
- * Edge-to-edge flatness can be achieved easily
- * More than 30 times better in sledge generation. Significantly lower than other abrasives
- * Reflective finish as compared to matte finish in other abrasives
- * One step light cleaning



SOLUTION FOR OPTICS & PHOTONICS INDUSTRY

OVERVIEW:

In the next few decades more opportunities arising from optics and photonics offer the potential for even greater social impact including solar power generation and new efficient lighting. Designers have been imagining new methods to use optics and photonics increasing manufacturing complexities.

Optics and photonics technologies are ubiquitous.

The materials include but not limited to Sapphire, Zinc Selenide, Zinc Sulfide, Germanium, Calcium Fluoride, Magnesium Fluoride, Silicon Carbide, Beryllium, Yttrium-Aluminum Garnet, and Gallium Nitride. Precision surfaces of these types of optical grade have been in great demand. It is critical for the polishing operation of optical fabrication process as it determines the final surface quality.

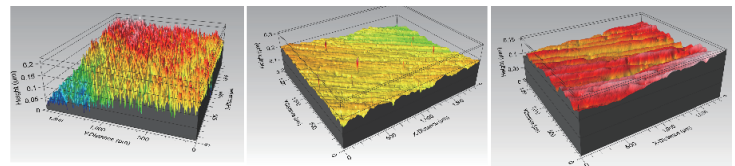
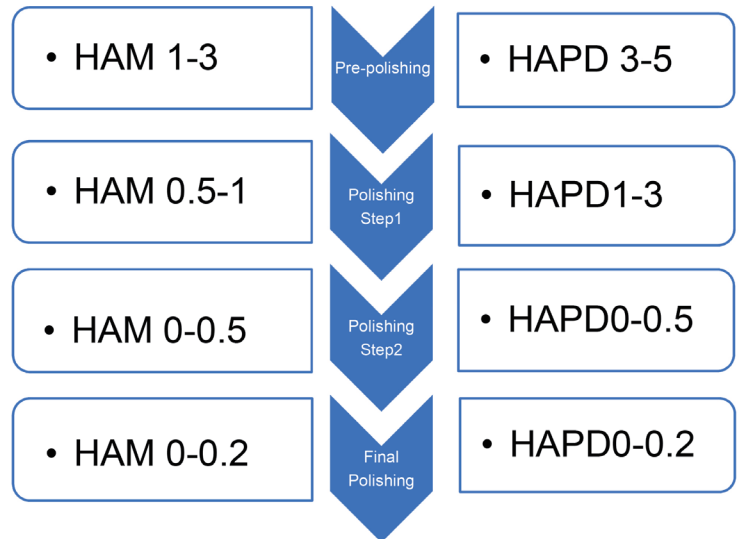
APPLICATION:

Industries	Materials	Hydroqual Mono Diamond Slurry	Hydroqual Poly D Diamond Slurry
Optics & Photonics	Fused Silica	✓	✓
	Sapphire	✓	✓
	Ceramic	✓	✓
	Zinc Selenide	✓	✓
	Zinc Sulfide	✓	✓
	Germanium	✓	✓
	Optical Sapphire	✓	✓
	Optical glass filter	✓	✓
	Infrared Crystal Silicon	✓	✓
	MgF ₂	✓	✓
	CaF ₂	✓	✓
	BaF ₂	✓	✓
	Lithium Fluorine	✓	✓

SOLUTION:

Monocrystalline Diamond Size (µm)

Polycrystalline Diamond Size (µm)



Germanium Initial Surface Roughness (Mono Ra =6.2 nm)

Germanium Polished using Hydroqual Mono 0.5-1µ slurry (Ra =1.0nm)

Germanium Polished using Hydroqual Mono 0.0/0.2 µm slurry (Ra =0.24nm)

Optics/Photonics Case Study

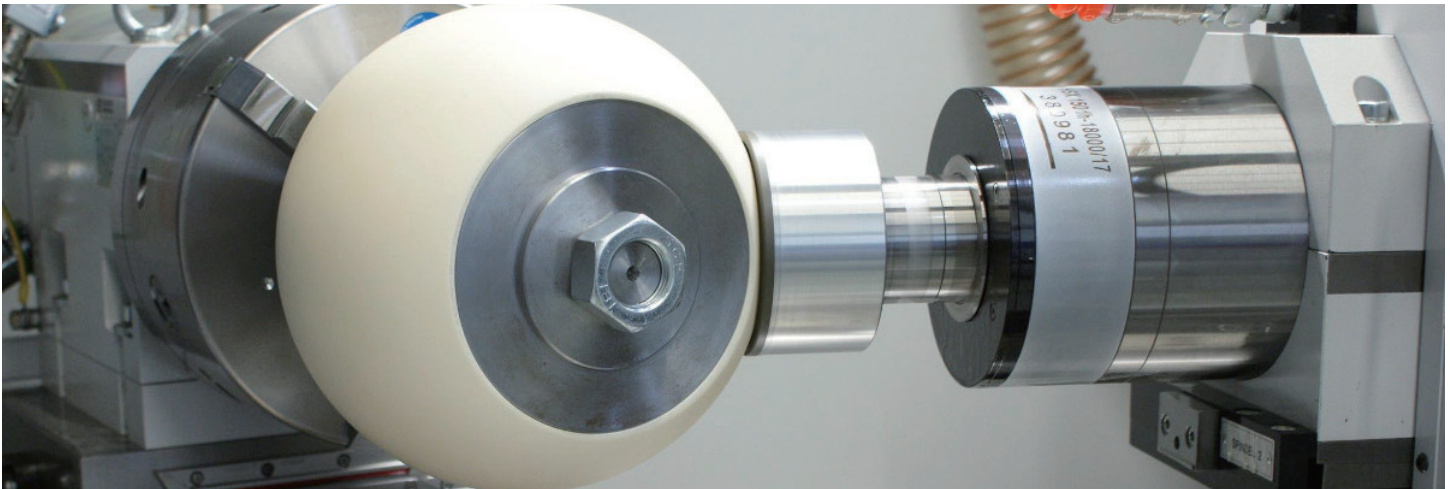
BENEFIT:

- * Higher stock removal rate as compared to other slurries
 - * Reduced number of process steps
 - * Lower slurry consumption compared to other abrasive slurries
- Both HAM, HAPD, HSD, HSPD can be used in these industries
- * Faster epoxy removal and consistent surface finish
 - Sub-Nano scale surface roughness can be achieved

- * No sledge generation as compared to other slurries
- * Edge-to-edge flatness in the case of flat components
- * No accumulation of sledge in case of curved components
- * Can be used in both standard and precise polishing of super hard optical devices
- * One step light cleaning



SOLUTION FOR ADVANCED CERAMIC INDUSTRY



OVERVIEW:

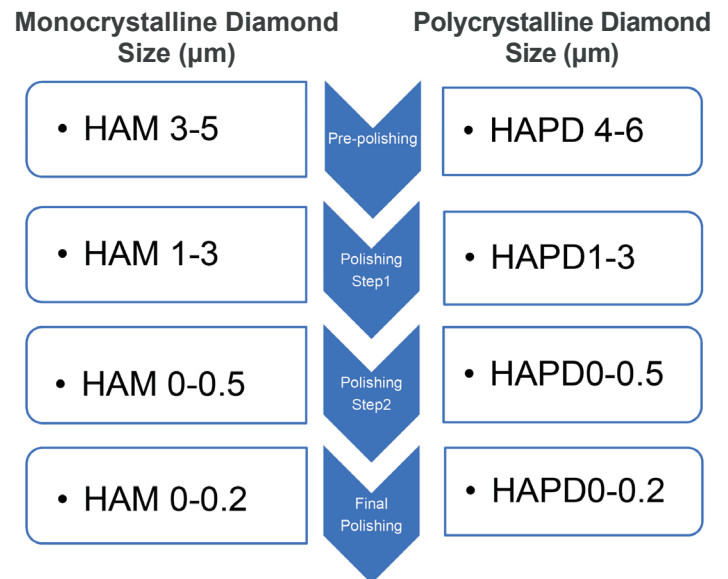
The applications of advanced ceramics are mainly in the manufacturing of electronic and electrical equipment due to excellent electrical properties and high corrosive resistance. Performance and high quality are the advantages of advanced ceramics. The most significant products include monolithic, coatings, and ceramic matrix composites.

APPLICATION:

Industries	Materials	Hydroqual Mono Diamond Slurry	Hydroqual Poly D Diamond Slurry
Advanced Ceramic	Mercury Cadmium telluride	✓	✓
	Boron Carbide	✓	✓
	Aluminum Nitride	✓	✓
	Silicon Carbide	✓	✓
	Silicon Nitride	✓	✓
	Tungsten Carbide	✓	✓
	Zirconia	✓	✓
	Alumina	✓	✓
	Silicates	✓	✓

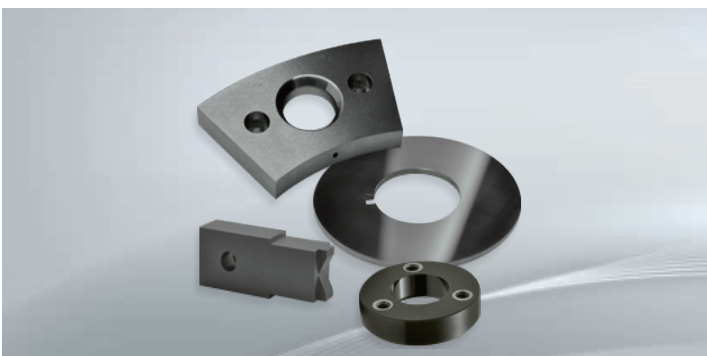
The ceramic industry is facing an ever-increasing demand to finish parts to precise dimensions. Flat lapping while using diamond slurry is often the processing option for precision finishing of a ceramic surface.

SOLUTION:



BENEFIT:

- * Reduced number of process steps
- * Higher removal rate
- * Lower slurry consumption compared to other abrasive slurries
- * More than 30 times better in sledge generation. Significantly lower than other abrasives
- * Reflective finish as compared to matte finish in other abrasives
- * One step light cleaning

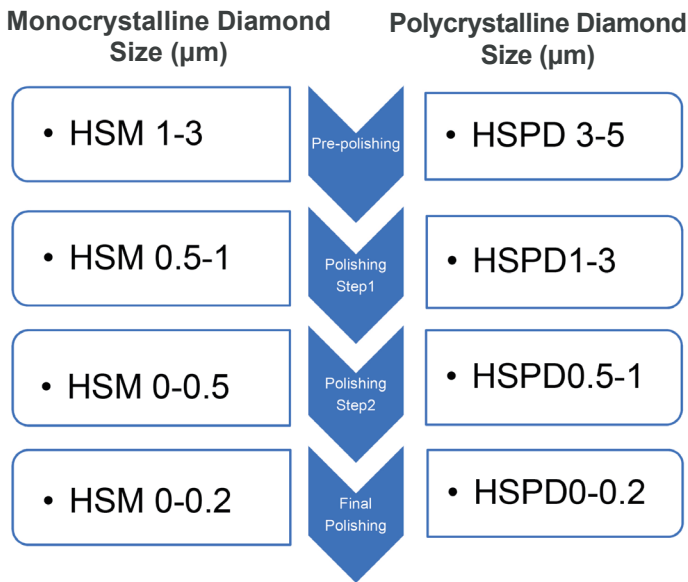


SOLUTION FOR METALLOGRAPHIC POLISHING

OVERVIEW:

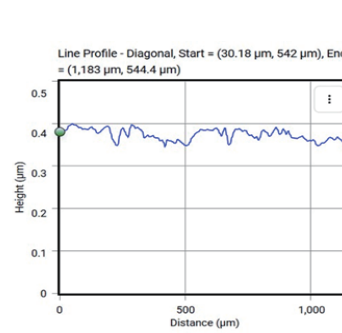
Diamond slurries have proven to show excellent performance in addressing these surface imperfection issues arising from other abrasives. The new sub-micron level diamond slurries along with new microscopic technologies are leading the metallographic technology to a new frontier.

SOLUTION:

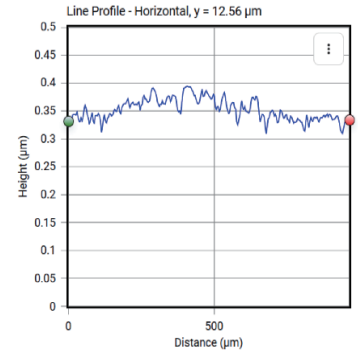


APPLICATION:

Industries	Materials	Hydroqual Mono Diamond Slurry	Hydroqual Poly D Diamond Slurry
Metal	Cast Iron	✓	✓
	Titanium Alloys	✓	✓
	Steel	✓	✓
	Nickle-based Superalloys	✓	✓
	Bronze	✓	✓
	Brass	✓	✓
	Cermets	✓	✓



Vertical, Diagonal, Horizontal surface roughness profile line using Hydroqual Mono S 1-3 (HSM) slurry



Vertical, Diagonal, Horizontal surface roughness profile line using Hydroqual Poly S 1-3 (HSPD) slurry

BENEFIT:

- * The common polishing and pre-grinding method involves multiple steps of SiC paper polishing. In fact, the steps required in SiC polishing are twice more than listed above
- * SiC polishing or other abrasive polishing consumables run out quickly as compared to diamond slurry polishing
- * The frequent change of SiC polishing papers along with their wear time lead to significant cost

- * Diamond removes stocks faster, leaves excellent surface finish, no need of much cleaning as compared to SiC polishing, reduces steps in polishing phase
- * The HSM and HSPD packages by Qual Diamond are an ideal combination for metallographic and material graphic polishing
- * These packages reduce steps significantly by eliminating the intermediary steps as compared to other polishing mechanisms





OUR DIAMOND SLURRY SPECIFICATION:

Slurry Types	Diamond Size (µm)	Concentration (g/l)	Viscosity (cpm)	PH	Stability
MONO	0-0.2	1	A 100-150	6-7	Stable
HAM	0-0.25				
HSM	0-0.5	2	B 200-300	7-8	
	0.5-1				
	1-2				
	1-3	5	C 500-800	8-9	
	2-3				
POLY	3-5	10	D over 1000		
	5-7				
	4-6				
	6-12				
HAPD	7-10				
HSPD	10-20				
HAPH	20-30	25			
HSPH	30-40				
	40-50	50			

MICRO/NANO/ROUND DIAMOND POWDER:

Qual Diamond's diamond powder is categorized to QND diamond-nano particle size, QMD diamond Micro particle size, QYD Diamond-Round diamond particle, Which are all treated with Qual Diamond's unique surface modification technology and special

size treatment, no aggregation, ready to use for optics, semiconductors, advanced ceramics and metal precision lapping and polishing.

Surface modified and purified micro diamond; narrow size distribution and high dispersion efficiency.



Qual Diamond

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