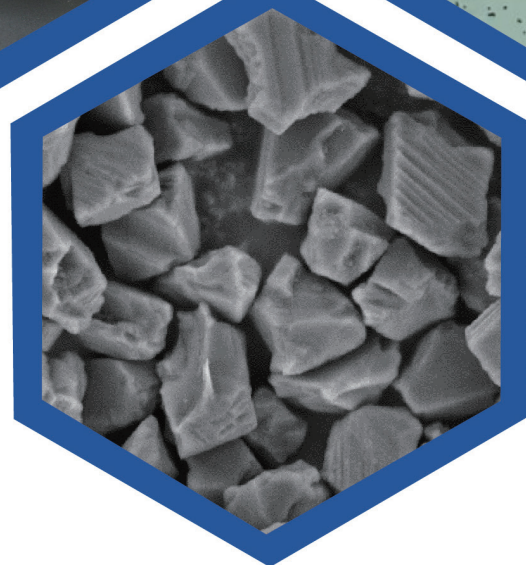
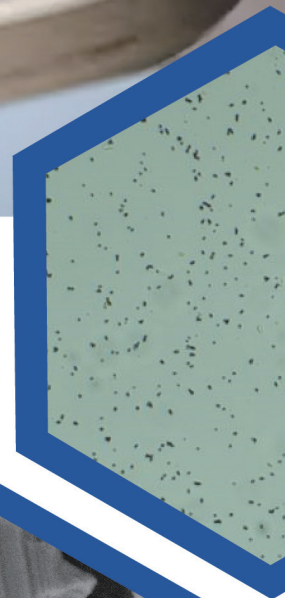





# SOLUTION FOR LAPPING/ PRECISION POLISHING

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

Qual Diamond has accumulated 30 years experience in R&D and production of industrial synthetic diamonds and diamond tools. We specialize in developing the diamond powder, slurry, and suspension relevant to various advanced technologies and applications. Our success is derived from collaboration and dedication to technical support.

Each step of our process is rigorously controlled from procuring raw materials to the finished products. We achieved ISO accreditation for 9001 and 14001 and follow them strictly. With strong motivation for corporate social responsibility, all raw production materials we adopt are eco-friendly and recyclable. Our guarantee of consistent quality is a result of advanced precision testing and inspection equipment. Our technical QC team inspects particle shape, distribution, elemental analysis, and detects for any impurities.

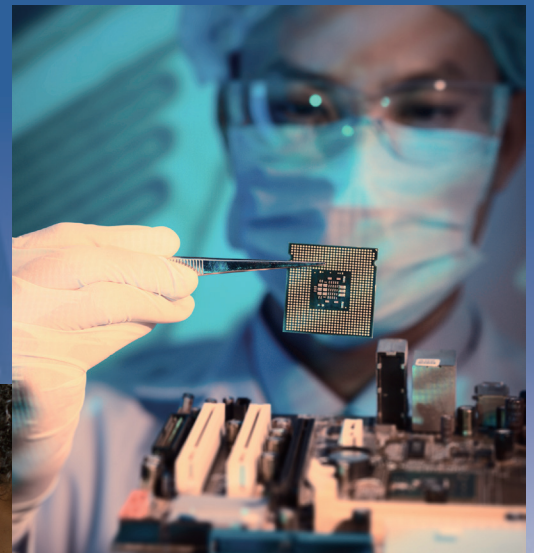
Our dedicated team is thrilled to assist and offer the most optimized solutions to meet the critical demands of many various industries; such as, aerospace, automotive, defense, electronics, medical, advanced ceramics, metal, glass, and more. We hope we can create endless possibilities using the power of diamonds together.

## 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.



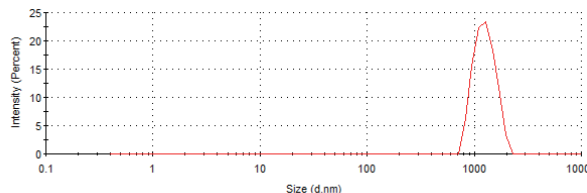
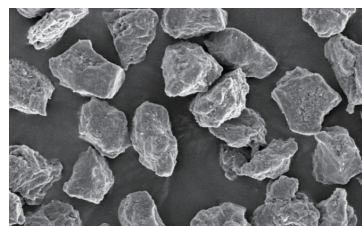


# HAPD/HSPD Diamond Slurry

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 increase 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:	1mg/ml, 2mg/ml, 5mg/ml, 10mg/ml, 25mg/ml, 50mg/ml			
Available Viscosity:	A 100-150cpm, B 200-300cpm, C 500-800cpm, D over1000cpm			
Available Package:	250ml 500ml 1L 1G			

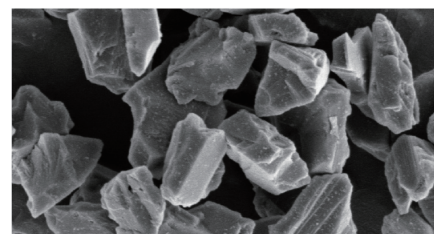


# HAPH/HSPH Diamond Slurry

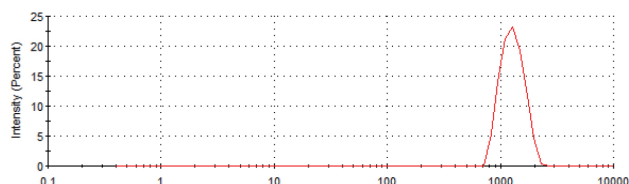
HAPH: Hydroqual Advanced High-Pressure High-Temperature Polycrystalline Diamond Slurry  
 HSPH: Hydroqual Standard High-Pressure High-Temperature Polycrystalline Diamond Slurry



HAPH in different size of containers



SEM



Size distribution

## INTRODUCTION:

Qual Diamond's High-Pressure High-Temperature Polycrystalline Diamond Slurry is a hydro-based formulation. The slurries are made with High-Pressure High-Temperature 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 faster 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 slurries increase 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	Grits 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:	1mg/ml, 2mg/ml, 5mg/ml, 10mg/ml, 25mg/ml, 50mg/ml			
Available Viscosity:	A 100-150cpm B 200-300cpm C 500-800cpm D over1000cpm			
Available Package:	250ml 500ml 1L 1G			



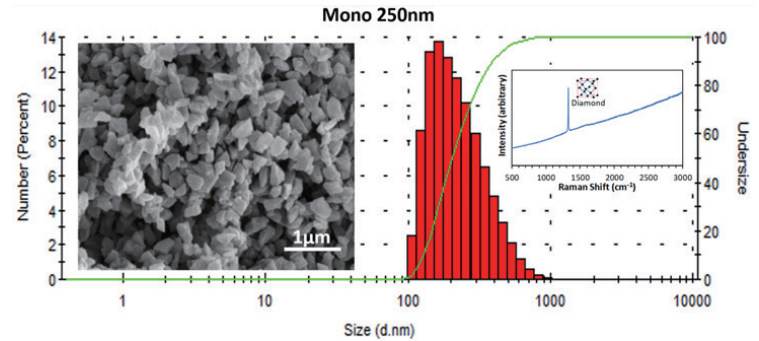
# HAM/HSM Diamond Slurry

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.

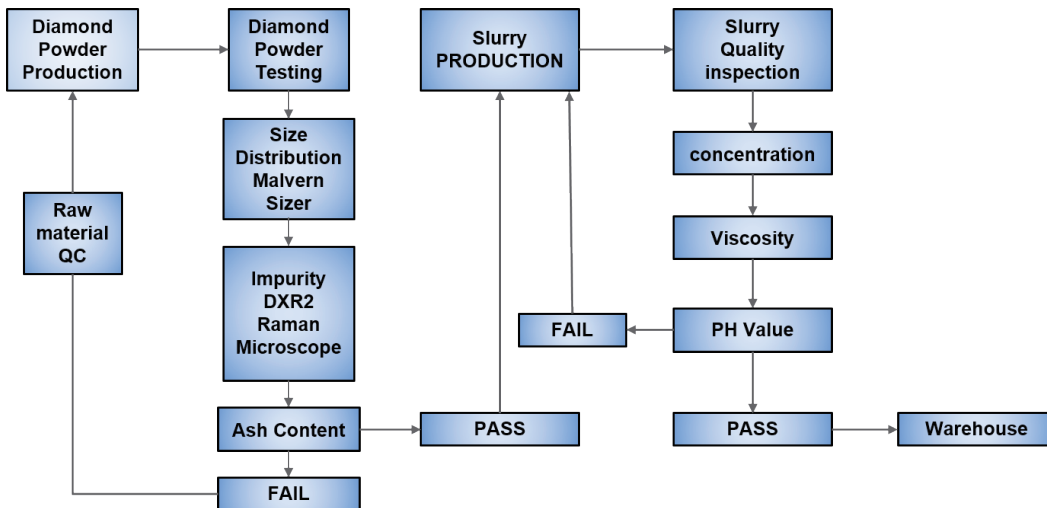
## FEATURES:

- ◆ 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:	1mg/ml, 2mg/ml, 5mg/ml, 10mg/ml, 25mg/ml, 50mg/ml			
Available Viscosity:	A 100-150cpm, B 200-300cpm, C 500-800cpm, D over1000cpm			
Available Package:	250ml 500ml 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 are 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 standard; 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 every 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.

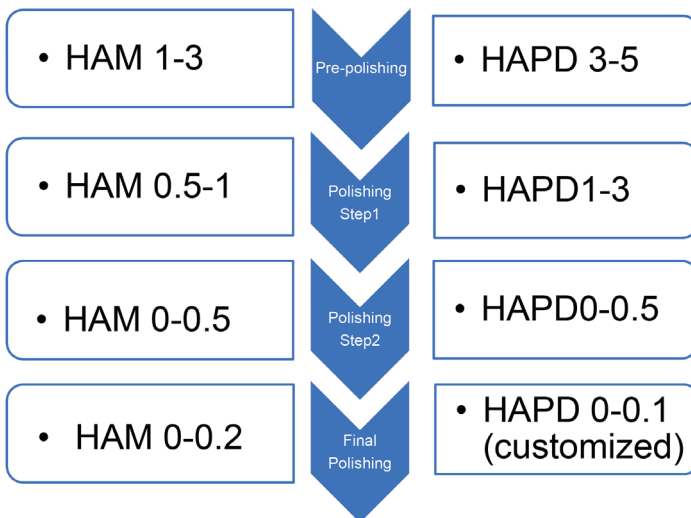
In silicon wafer thinning, size distribution of diamond is critical importance to have a consistent edge-to-edge flatness and a good aspect ratio. Qual Diamond can customize diamond slurries based on these requirements using our high quality, and very narrow size distribution diamond powders.

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 ( $\mu\text{m}$ )

Polycrystalline Diamond  
Size ( $\mu\text{m}$ )

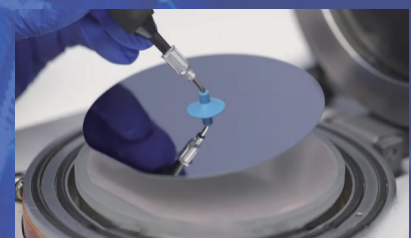
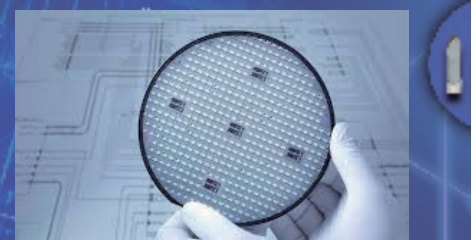


## APPLICATION:

Industries	Materials	Hydroqual Mono Diamond Slurry	Hydroqual Poly D Diamond Slurry
Semi-conductor	Al <sub>2</sub> O <sub>3</sub>	✓	✓
	SiO <sub>2</sub>	✓	✓
	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 materials have been in great demand. It is critical for the polishing operation of optical fabrication process as it determines the final surface quality.

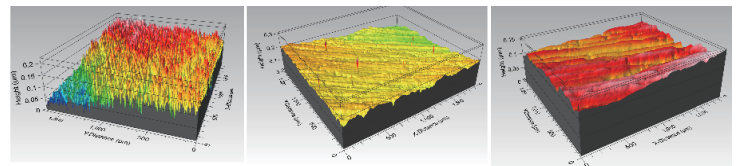
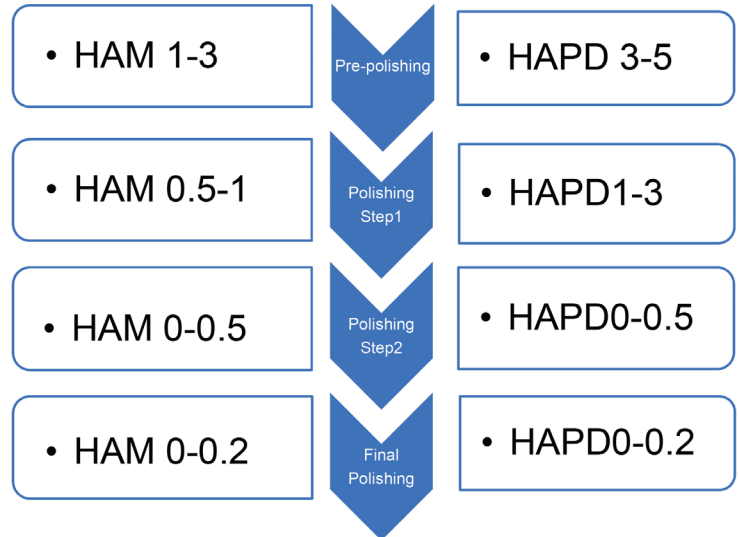
## APPLICATION:

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 <sub>2</sub>	✓	✓
	CaF <sub>2</sub>	✓	✓
	BaF <sub>2</sub>	✓	✓
	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:

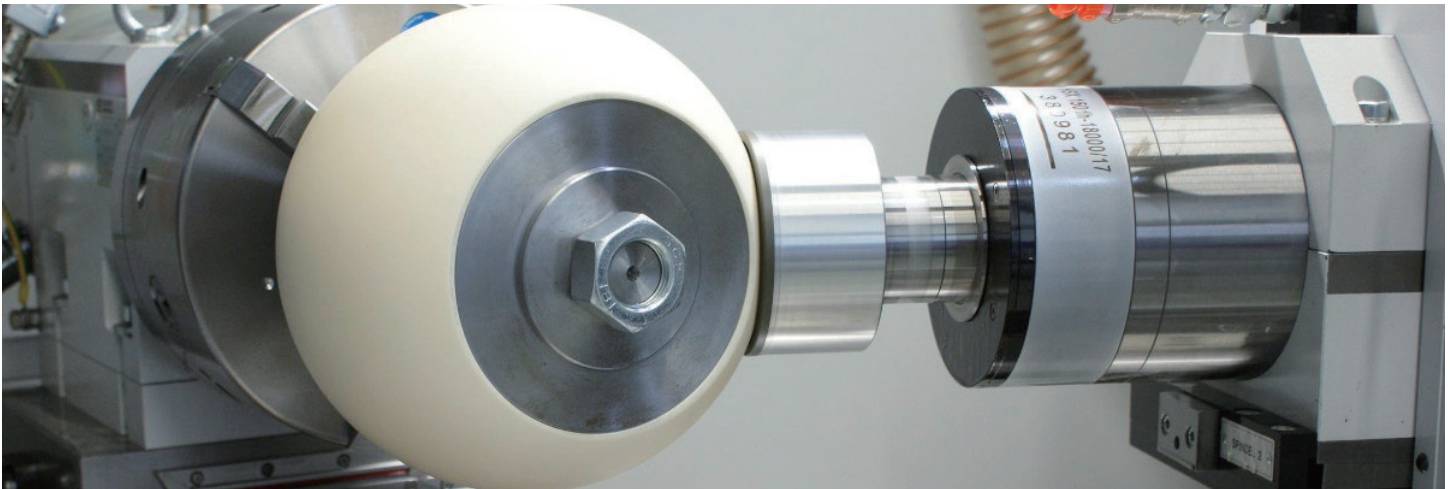
- \* Higher stock removal rate as compared to other slurries
  - \* Reduced number of process steps
  - \* Lower slurry consumption compared to other abrasive slurries
- Both HAM, HAPD, HSD, HSPD can be used in these industries
- \* Faster epoxy removal and consistent surface finish
  - Sub-Nano scale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

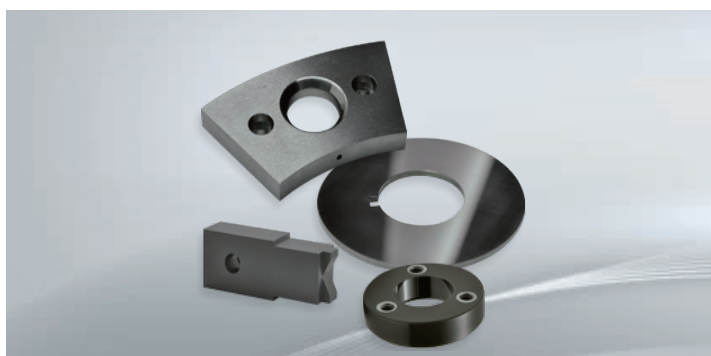
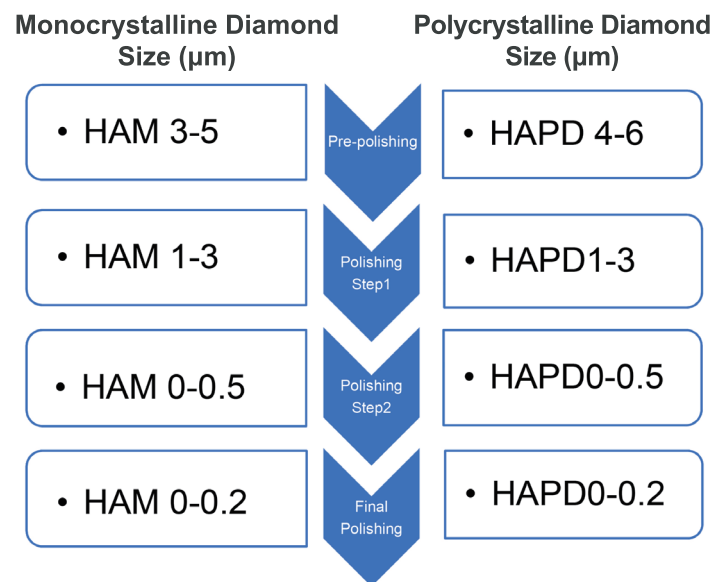
The applications of advanced ceramics are mainly in the manufacturing of electronic and electrical equipment due to excellent electrical properties and high corrosive resistance. Performance and high quality are the advantages of advanced ceramics. The most significant products include monolithic, coatings,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

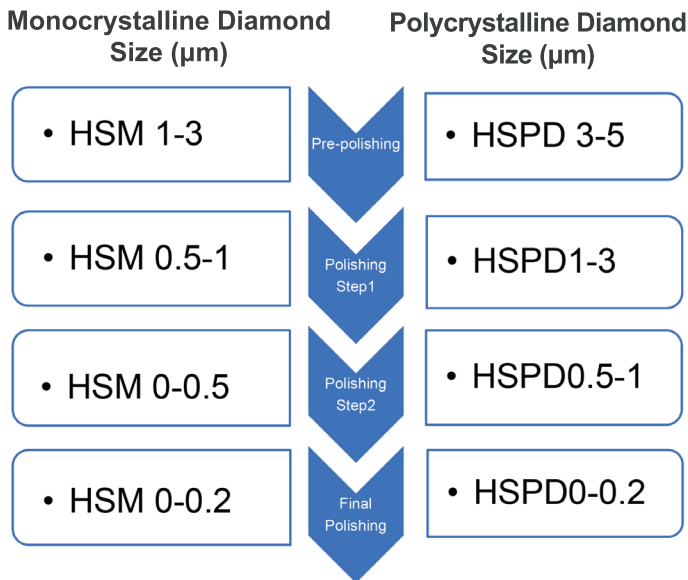
- \* Reduced number of process steps
- \* Higher removal rate
- \* Lower slurry consumption compared to other abrasive slurries
- \* More than 30 times better in sledge generation. Significantly lower than other abrasives
- \* Reflective finish as compared to matte finish in other abrasives
- \* One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

# SOLUTION FOR METALLOGRAPHIC POLISHING

## OVERVIEW:

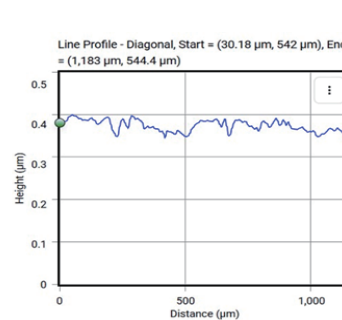
Diamond slurries have proven to show excellent performance in addressing these surface imperfection issues arising from other abrasives. The new sub-micron level diamond slurries along with new microscopic technologies are leading the metallographic technology to a new frontier.

## SOLUTION:

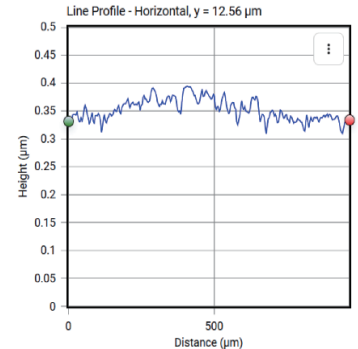


## APPLICATION:

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





# CUSTOMIZATION

## OUR DIAMOND SLURRY SPECIFICATION:

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

## MICRO/NANO/ROUND DIAMOND POWDER:

Our micro-diamond powders consist of uniform size, high purity, diamond particles. Our unique powder treatment technology prevents agglomeration and aggregation of particles. The relatively uniform shape results in higher material removal rates when used in grinding applications. They are convenient for lapping and polishing in a wide variety of applications; such as, quartz, ceramic, optical,

semiconductor, advanced composite materials, and more.

We have both monocrystalline and polycrystalline diamond powders with (S)tandard, (H)ydrophilic, and (D)eagglomerated formulations. They are categorized as follows: Mono series QMM-S, QMM-H, QMM-D. Poly series QPD-S, QPD-H, QPD-D. Nano series QND, and Round diamond series QMR.”



# Qual Diamond

Hi-tech Corporation



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