

# Alumina Polishing Abrasives

## Alumina Abrasives

There are a number of different types of alumina polishing abrasives. These abrasives are categorized by their manufacturing process, crystal structure (hardness) and sizing or classification process. The main types of polishing alumina are calcined and polycrystalline abrasives. Calcined powders include fused, platey or levigated (air classified / sized) alumina. The two common alumina abrasive crystals include the harder alpha alumina (Mohs hardness 9) and the softer (Mohs hardness 8) gamma crystal structures.

## Calcined / Fused Alumina

Calcined alumina powders are typically used for metal lapping and polishing, as well as have been the traditional rough and final polishing abrasive for many years and are relatively inexpensive and readily available.

Calcined alumina grains consist of single platey crystals, whereas fused alumina is more blocky in shape. A perfect calcined alumina particle would be a six-sided disk, with a thickness of about 1/5 of its diameter.

Calcined alumina is typically very pure (>99%), whereas the purity of fused alumina can vary from 96% to 99+%. The issue with the calcined powders is agglomeration. Agglomeration occurs because small dry powders exhibit electrostatic forces which cause the fine particles to be attracted to each other, thus forming larger particles. For example, the agglomerated or standard version of a 0.05 um alumina crystal can form an agglomerate size as large as 40 um. When polishing hard samples these agglomerates can often be broken down, however for



**Polycrystalline Alumina**



**Calcined Alumina**

soft materials such as aluminum, copper, zinc, etc. these fine agglomerated abrasives can form large random scratches.

## *Agglomerated vs. Deagglomerated*

The term deagglomeration refers to the process by which a dry agglomerated particle is milled or broken down. The deagglomeration process consists of jet blasting the agglomerate particles at each other at high velocities, thus breaking down the agglomerate size. The process is only moderately successful, but can be significant for fine polishing.



**PACE TECHNOLOGIES**

**Final Polishing  
Alumina**

**-Polycrystalline  
-Calcined  
-Fused  
-Levigated  
-Deagglomerated**

Property	Polycrystalline	Calcined	Fused	Levigated
Crystal Structure	Polycrystalline alpha alumina	Monocrystalline alpha alumina	Alpha alumina	Monocrystalline
Shape	Microcrystallites	Hexagonal platelets	Hexagonal platelets	Hexagonal platelets
Particle size	0.05 micron	Submicron up to 30 microns	5-70 microns	3-5 microns (air-classified)
pH	4 and 10	8-11		
% solids	15-25%			
Hardness	Knoop 2000 (Mohs 9)	Knoop 2000 (Mohs 9)	Knoop 2000 (Mohs 9)	Mohs 8,9
Applications	pH 4 - metal polishing pH 10 - ceramic polishing	-Metal lapping and polishing -Lapping film abrasives	-Lapping compounds	General purpose alumina -Polishing and buffing

## Polycrystalline Alumina

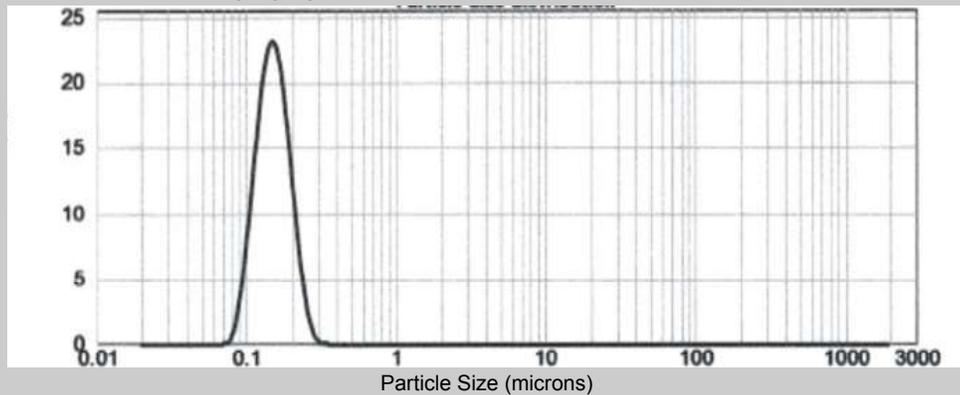
Polycrystalline or nanometer alumina is a colloidal alumina which is manufactured by a proprietary process. This processing offers two significant improvements over conventional alumina calcining processes:

1. Tighter more controlled particle size distributions
2. Harder alpha alumina phase

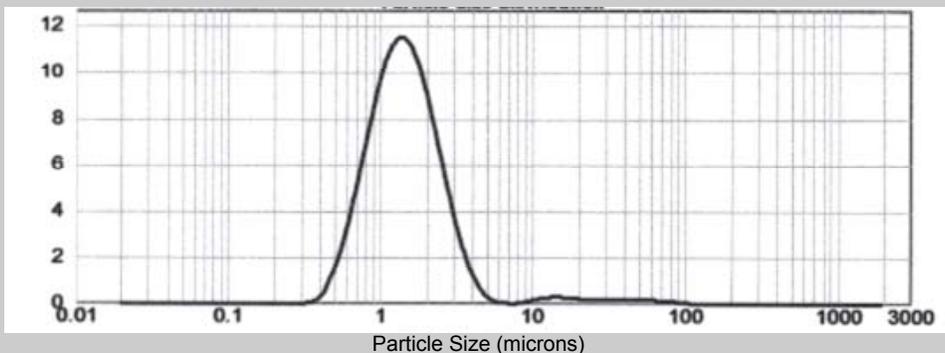
A tighter more controlled particle size distribution is a result of less particle aggregation. For example, standard calcined 0.05 um gamma alumina products form aggregate sizes as large as 5 um. These aggregates can be broken down during polishing with harder specimens. However, these large aggregates have been known to cause significant scratching in soft metals such as aluminum, tin, lead, copper and soft steels.

Nanometer alumina is specifically milled to produce a much smaller aggregate particle size distribution (<0.5 um). Nanometer alumina is also the harder alpha alumina particle, therefore making it a more efficient cutting abrasive. Thus nanometer alumina is a much more controlled polishing abrasive than calcined gamma alumina.

*0.05 micron polycrystalline alumina*



*0.05 micron deagglomerated calcined alumina*



### *Polycrystalline acidic alumina*

Crystal Size (nm)	0.05-0.10
D50 (nm)	0.18-0.21
D0.1	0.50 max
pH	9.5-10.5
% solids	14-16

### *Polycrystalline alumina*

Crystal Size (nm)	0.05-0.10
D50 (nm)	0.09-0.11
D0.1	0.40 max
pH	3.5-4.5
% solids	19-22

# Technical Specifications

## 0.05, 0.30 micron deagglomerated alumina powders

Particle size	0.05 micron	0.3 micron
Crystal Form	Gamma	Alpha
Shape	Cubic, deagglomerated	Hexagonal, deagglomerated
Surface area, m <sup>2</sup> /gm	100	15
Hardness	8	9
pH (recommended)	7.5-8	7.58-8

Al <sub>2</sub> O <sub>3</sub>	>98%
Ca	<5 ppm
Fe	<10 ppm
K	<60 ppm
Na	<20 ppm
Si	<45 ppm

## 0.30 micron high density alumina powders

Crystal Form	Monocrystalline alpha alumina
Shape	Hexagonal platelets, deagglomerated
Hardness	Knoop - 2000
pH (recommended)	9-10.5
Specific gravity	3.95 gm/cc

Al <sub>2</sub> O <sub>3</sub>	>99%
SiO <sub>2</sub>	0.06% max
Fe <sub>2</sub> O <sub>3</sub>	0.03% max
Na <sub>2</sub> O	0.60% max
TiO <sub>2</sub>	0.02% max
CaO	0.07% max
MgO	0.05% max

## 240, 400, 600 grit alumina powders

Crystal Form	Monocrystalline alpha alumina
Shape	Hexagonal platelets, deagglomerated
Hardness	Knoop - 2000
pH (recommended)	9-10.5
Specific gravity	3.95 gm/cc

## 0.05 micron Nanometer alumina slurry

Crystal Form	Polycrystalline alpha alumina
Size	0.05 - 0.10 microns
Hardness	Knoop - 2000
pH (recommended)	4 (acidic) or 10 (basic)
% solids	15% for pH 4 20% for pH 10

Al <sub>2</sub> O <sub>3</sub>	>98.7%
SiO <sub>2</sub>	0.06% max
Fe <sub>2</sub> O <sub>3</sub>	0.03% max
Na <sub>2</sub> O	0.60% max
TiO <sub>2</sub>	0.02% max
CaO	0.07% max
MgO	0.05% max

## NANOFINISH alumina suspension

Crystal Form	Polycrystalline alpha alumina
Size	0.05 - 5 microns
Hardness	Knoop - 2000
pH (recommended)	10
% solids	20

## Product Descriptions

### Alumina Slurries

Product Name	Size	Catalog Number
0.05 um Nanometer Alumina (pH 10)	16 oz	NA-1005-16
	32 oz	NA-1005-32
	1 gallon	NA-1005-128
0.05 um Nanometer Alumina (pH 4)	16 oz	NA-1020-16
	32 oz	NA-1020-32
	1 gallon	NA-1020-128

### Alumina Suspensions

Product Name	Size	Catalog Number
0.05 um Nanofinish Alumina	6 oz	NANO-1005-06
	1 gallon	NANO-1005-128
0.3 um Nanofinish Alumina	6 oz	NANO-1003-06
	1 gallon	NANO-1003-128
0.5 um Nanofinish Alumina	6 oz	NANO-1105-06
	1 gallon	NANO-1105-128
1 um Nanofinish Alumina	6 oz	NANO-1010-06
	1 gallon	NANO-1010-128
3 um Nanofinish Alumina	6 oz	NANO-1030-06
	1 gallon	NANO-1030-128
5 um Nanofinish Alumina	6 oz	NANO-1050-06
	1 gallon	NANO-1050-128

### Fine Alumina Powders

Product Name	Size	Catalog Number
0.05 um deagglomerated alumina powder	1 lb	ALR-0105-01
	5 lbs	ALR-0105-05
0.3 um deagglomerated alumina powder	1 lb	ALD-0103-01
	5 lbs	ALD-0103-05
0.3 um high density alumina	1 lb	ALR-0103-01
	5 lbs	ALR-0103-05
1 um alumina powder	1 lb	ALR-1010-01
	5 lbs	ALR-1010-05
3 um Alumina powder	1 lb	ALR-1030-01
	5 lbs	ALR-1030-05
5 um Alumina powder	1 lb	ALR-1050-01
	5 lbs	ALR-1050-05

### Coarse Alumina Powders

Product Name	Size	Catalog Number
240 grit alumina powder	5 lbs	ALR-0240-05
400 grit alumina powder	5 lbs	ALR-0400-05
600 grit alumina powder	5 lbs	ALR-060-05



## PACE TECHNOLOGIES

*PACE Technologies*  
1802 W. Grant Rd. Bldg 102  
Tucson, AZ 85745 USA  
Phone 520-882-6598  
FAX 520-882-6599  
[www.metallographic.com](http://www.metallographic.com)  
email [pace@metallographic.com](mailto:pace@metallographic.com)