

Abrasives and their Properties

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About GMA

- GMA is the trusted global leader in industrial garnet and pyroxene.
- Our focus is providing the highest quality industrial garnet for the surface preparation and waterjet cutting industries.
- We offer secure garnet supplies, expert advice and a complete range of premium products.





ABRASIVE MEDIA & IT'S PROPERTIES

Types of Abrasive Blast Media



ABRASIVE MEDIA & ITS PROPERTIES

Abrasive Selection Criteria



The choice of abrasive affects....

- ✓ Productivity
- ✓ Environmental Impact
- ✓ Safety Risk to Workers
- ✓ Quality of Substrate
- ✓ Surrounding Equipment
- ✓ Cost of disposal

Standards & Specifications

Surface Finish



FOUR CRITICAL ARRASIVE CHARACTERISTICS



ABRASIVE MEDIA & ITS PROPERTIES

Mohs Scale of Hardness

- 1. Talc
- 2. Baking Soda
- 3 4 Plastic Beads, Mag. Sulfate,
- 5. Silica Sands
- 5.5 6 Crushed Glass
- 7 Staurolite, Slags
- 7 8 Garnets
- 9 Quartz, Aluminum Oxide
- 10 Diamond

The Mohs scale of mineral hardness was created in 1812 by a German Geologist and is based on the ability of a harder mineral to be able to scratch a softer mineral.

How Toughness Relates to Production

Toughness

Lower friability the better, which means the grains will resist breakdown on impact, creating a higher surface profile, greater productivity and producing less dust.



Tough Low Friability Tougher grains generate a cleaner, more consistent profile **Higher Friability** Weaker with more fracture plains that shatter on impact.

Extremely Friable Weak with increased fracture plains and inclusions that shatter on impact creating high levels of dust.

Tougher Grains Resist Breakdown

Tougher means grains will resist breakdown on impact and creates less dust.



Some products have internal fractures and impurities. They are highly friable and break on impact creating excessive dust.

Bulk Density/Specific Gravity

An abrasive's Bulk Density/Specific Gravity will have a great effect on its productivity.

- Bulk Density measure in lbs. per cubic ft.
- Specific gravity is the ratio of the weight of a volume of the substance to the weight of an equal volume of the reference substance. Reference = water
- Examples: <u>Glass Bead 2.5</u> <u>Slag 3.8</u> <u>Garnet 4.1</u>
- Higher the density the greater the productivity.
- The higher density particles convey more energy to the surface therefore creating more work.
- Faster cleaning rates.
- Greater profiles

Angularity

Angular/Semi Angular/Rounded

- Angular used for coatings and rust removal.
- Angular will create a deeper more angular profile.
- Rounded good for harder more brittle coatings such as old coatings and mill scale.
- Rounded leaves more of a peened surface appearance.
- A mixture of both or a semi angular material works well in many blast cleaning jobs.



Surface Cleanliness/Embedment



Mineral Purity and Surface Contamination



By Product Purity and Surface Contamination





Some abrasives have close to 60% abrasive embedment on surface

Invisible to the eye, embedment and contaminants can result in premature coating failures.

This may cause:

- High clean-up costs
- Corrosion & blistering
- Possible warranty claims
- High rework costs

Under the Microscope

Embedment Contamination

Surface Cleanliness/White Metal



How Clean is the Surface?





ABRASIVE SIZING

Why Blasting Abrasive Size Matters

A general rule - the finest abrasive should be specified to obtain the required surface preparation.

A fine abrasive will give you more:-

- impacts per volume
- more particles to clean the surface and work harder

However, you need to prepare the surface for a coating and essentially meet surface preparation specification.

Mesh	Microns	Relative Grain Size
30	600	
40	475	D.
60	250	
80	180	0
100	150	<i>(</i>)
120	125	(7)

Particle Size Distribution

Typical blasting abrasive media is generally one-dimensional, consisting of either concentrated coarse particles or concentrated finer particles.

A wider particle size distribution enables effective coating removal and profile depth by coarse particles, enhanced by the efficiency and cleaning benefits of the finer particles.



Typical 20/40 Mesh Abrasive

Typical 80 Mesh Abrasive

Typical one-dimensional abrasives risk effective coating adhesion and asset life.

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What Can Make an Abrasive Even?

Angular and sub-angular grains

Engineered blends combine large angular and small sub-angular grains to effectively 'cut and clean' the surface.



Engineered blend of large and small grains

Greater peak density, cleaner surface = increased coating adhesion

Greater Profile Uniformity = Better Coating Adhesion

Extending Coating Life with Unrivalled Adhesion

Abrasive can provide up to **4 times** higher peak density compared to slag abrasives.

Product A

Uniform profile with increased surface area Up to 24,000 peaks per in^2

Product B

Non-uniform surface profile Low peak density (avg. 6,000 peaks per in²) Possible high levels of embedment and contamination in troughs Some products create an increased concentration of uniform peaks per in² on the surface, resulting in less coating used and greater adhesion.

Peak Density = Better Coating Adhesion

Source: In depth Comparison Report on USA Blasting Products, April 2019



Peak Density

Direct Comparison All products by Peak Density								
Product	Surface	Test	Test X	Posi	Peak Density			
Na tura I Mineral	mil scale	Test D	2.20	2.30	24884			
Natural Mineral	mil scale	Test S	2.03	2.10	19728			
Natural Mineral	mil scale	Test Q	1.47	1.87	17853			
Natural Mineral	mil scale	Test R	2.93	3.00	16447			
Natural Mineral	mil scale	Test E	2.57	2.70	15105			
Natural Mineral	mil scale	Test C	2.70	3.03	14338			
Natural Mineral	mil scale	Test N	2.33	2.50	14061			
Na tura I Mineral	mil scale	Test B	3.50	3.50	13621			
Natural Mineral	mil scale	Test O	2.53	2.57	13507			
Natural Mineral	mil scale	Test U	3.2	3.5	12825			
Natural Mineral	mil scale	Test A	3.63	3.73	12534			
Natural Mineral	mil scale	Test T	2.93	3.07	9502			
Natural Mineral	mil scale	Test M	3.20	0.00	9459			
Natural Mineral	mil scale	Test F	4.03	4.50	8934			
By Product	mil scale	Test P	3.50	4.07	8053			
By Product	mil scale	Test I	3.17	3.53	7893			
By Product	mil scale	Test L	4.20	4.47	6988			
By Product	mil scale	Test H	3.60	3.90	6413			
By Product	mil scale	Test J	3.53	3.87	6368			
By Product	mil scale	Test K	5.90	8.07	6136			
By Product	mil scale	Test G	4.90	5.23	2511			

And LAST, But <u>Not</u> Least . . .

CHOICE OF ABRASIVE AFFECTS:

Quality of metal surface

- anchor profile
- cleanliness



This factor impacts the **<u>ultimate life</u>** of the coating.

FACT: 80% of premated due to **SUBS**

80% of premature coating failures (prior to end of coating life) are due to **SUBSTANDARD** surface preparation.



ENVIRONMENTAL IMPACTS & HEALTH BENEFITS

Heavy Metals, Heavy Risks

Waste product Abrasives

- Some abrasives are the waste product of burning coal and/or producing metals.
- Some abrasives can include traces of arsenic and chromium to nickel and vanadium.
- Heavy metals are highly toxic → Possible OSHA and/or EPA violations.

Beryllium's Health Risks

- International Agency for Research on Cancer (IARC) Class 1 Carcinogen.
- National Toxicology Program (NTP) Known Carcinogen.
- Exposure linked to both lung cancer and Chronic Beryllium Disease (CBD).



OSHA's Beryllium Limits

- 0.2 µg/m³ of air, averaged over eight hours.
- Short-term exposure limit (STEL) of 2.0 μg/m³ over a 15minutes period.

Does the chemical makeup really matter?

"So, what is that black dust on little Johnnies tricycle?"







Testing – Heavy Metals, Contaminants, Dust, etc?

• What are the measurements? Per PEL/Per Reporting

Example: $(\mu \ vs. \ m \ vs. \ \% \ by \ weight)$

• What is the RL on your test – Recordable Limit *(Correct for requirement)*

Example: (Below recordable limit? What limit?)

- Use of the word "NO" (Being below the RL doesn't mean "NO")
- Use of the word "Trace" (measurable amount below .1%)

Example: .09 vs. .000009 "Both contain Trace amounts"

• Is the test correct for the report? (NIOSH 7300M vs. EPA 1311)

Arsenic



Client Sample ID

Result(mg/Kg)

Chromium



Client Sample ID

Result(mg/Kg)

Beryllium



Client Sample ID

Result(mg/Kg)

Abrasive ADVANTAGE



Higher productivity

Superior cleaning rate against other abrasives.



Superior surface finish

Exceptionally clean surface & uniform profile.



Cost-effective

Lower garnet consumption, labor, clean up & disposal costs.



Safer

Meets all industry safety & environmental standards.



Abrasive A

Abrasive B



Questions?

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