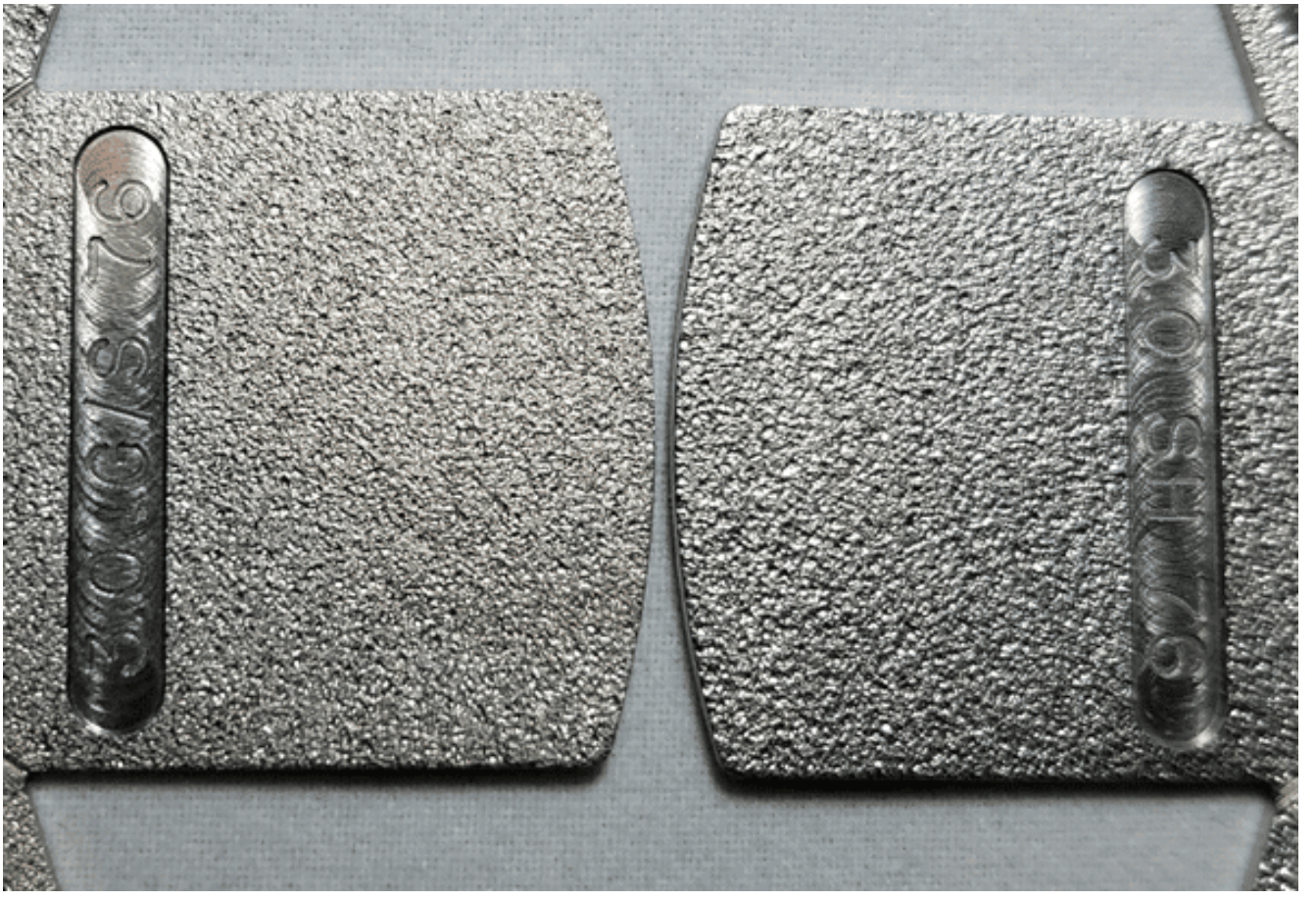
Expendable and Recyclable Abrasives – Pros and Cons

/ Abrasives / By Ken Trimber



The purpose of expendable and recyclable abrasives as used in this article is to prepare surfaces for the subsequent application of protective coatings. The SSPC glossary defines expendable and recyclable abrasives as follows:

Expendable Abrasive – *An abrasive that usually is discarded after one use*.

Recyclable Abrasive – *Abrasive blasting material such as steel shot and grit that can be cleaned and reused to*

reduce the total amount of abrasives consumed.

SSPC Abrasive Standard No. 1, "Mineral and Slag Abrasives" establishes 2 categories for abrasives that are expendable: Type I – Natural Mineral Abrasives ("... naturally occurring minerals, including, but not limited to, quartz sands, flint garnet, staurolite, and olivine...) and Type II – By-Product or Manufactured Abrasives ("Slag, manufactured, or by-product materials...").

SSPC Abrasive Standard No. 3, Ferrous Metallic Abrasive establishes two classes of abrasives that are recyclable: Class 1 – Steel Abrasive, and Class 2 – Iron Abrasive.

The abrasives are propelled against a surface at high velocity (typically 300 miles per hour or greater) to clean and roughen it. Cleaning removes surface material such as paint, and in the case of steel, rust and mill scale. The abrasive also creates a surface profile or roughness on the surface to improve the adhesion of the subsequently applied coatings.

The abrasives are propelled against the surface by compressed air (open nozzle blast cleaning), centrifugal force (rotary wheel blast cleaning), or water (water jetting with abrasive injection). Water can also be incorporated into open nozzle blast cleaning to control dust.

Compressed air still propels the abrasive, but water is used to create a slurry that is pushed through the blast hose, or the water is added to the abrasive at the nozzle. When selecting an abrasive, the method of cleaning that will be used must be taken into consideration.

While there are specific advantages and limitations with each abrasive type, all abrasives can achieve the various degrees of cleaning (e.g., white metal, near-white metal, etc.). Each abrasive type can also provide a range of profile depths, based on the various sizes of abrasive that are available.

Recyclable Abrasives

Recyclable abrasives are the abrasives of choice for rotary wheel blast cleaning because they can be recycled many times, often 100 or more, reducing both waste and abrasive costs. The spent abrasive is automatically collected, cleaned, and returned for reuse. The number of recycles achieved depends on the quality of the abrasive recycling system and how quickly the abrasive breaks down or changes shape, which is a function of abrasive type and hardness, and the hardness of the material being cleaned.

Shops using rotary wheel blast cleaning equipment prefer to use steel shot rather than steel grit because the angularity and sharpness of the grit causes more wear and tear on the equipment. While steel shot is fine for

most coatings, the angular profile created by steel grit is required for materials like metallizing and preferred for inorganic zinc rich primers. A compromise that is often acceptable for inorganic zinc rich primers is to create and maintain an operating mix of steel shot and steel grit, which reduces some of the wear, but still provides a surface profile with adequate angularity. For metallizing, though, the cleaning should be done with steel grit alone. Even then, the abrasive must be inspected and maintained because steel grit can round during repeated use, reducing the angularity of the profile, even though the depth of the profile may not change.

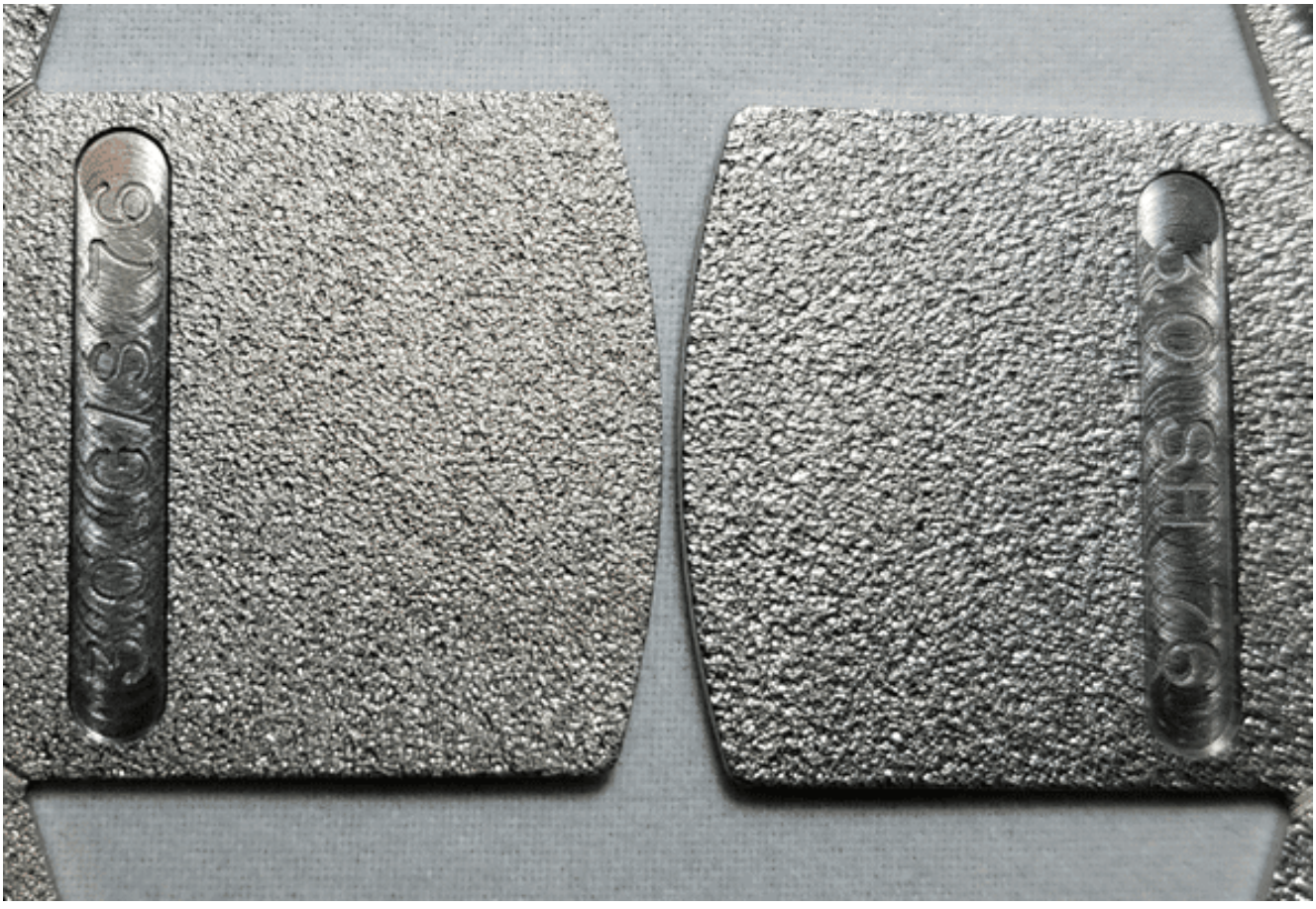


Figure 1 – Comparison of the 3.0 mil profile leaves of the Keane-Tator Surface Profile Comparator showing the difference between the rounded or peened texture created by steel shot (SH leaf on the right) and the angular profile created by steel grit or slag (G/S leaf on the left)

KTA conducted a study for a client to determine the effect that recycling of steel grit had on the shape of the abrasive, the shape and depth of the surface profile, peak count (the number of peaks in a unit area), and adhesion of a metallized coating. Metallizing was applied to steel test panels blast cleaned with new steel grit (which served as the baseline) and to steel panels blast cleaned with the same steel grit after multiple recycles. Each time metallizing was applied, the shape of the recycled grit used for surface preparation was examined microscopically and classified according to a pictorial standard for grain shapes developed by the American Geological Institute (AGI). The AGI categories are very angular, angular, sub-angular, sub-rounded, rounded, and well rounded. The shape of the abrasive, which was classified as very angular when new, changed as follows: 6 recycles (angular), 11 recycles (sub-angular), 30 recycles (sub-rounded), and 200 recycles (rounded). Although the surface profile and peak count measurements after recycling remained relatively constant when evaluated with Testex Press-O-Film Tape and a surface profilometer (stylus-type instrument), the angularity of the profile decreased as the shape of the abrasive became less angular during recycling. The effect of this physical change in the profile shape was a reduction of the adhesion of the metallized coating to the substrate. Although the adhesion was still acceptable on panels metallized after multiple recycles, it dropped measurably the more the abrasive was recycled. It is

important to note that this change in profile was not detected through the traditional methods of measuring profile depth. It was only discovered by examining the topography of the profile using images produced from Scanning Electron Microscopy (SEM). The changes in topography should have no effect on the performance of liquid-applied coatings, but if the adhesion of a metallized coating is unacceptable, or the adhesion drops the more the steel grit is recycled, changes in the topography of the profile would be worth investigating.

Recyclable abrasives are used with open nozzle blast cleaning in blast rooms where the abrasive is automatically reclaimed and recycled, as well as in closed blast cleaning systems like vacuum blasting. Recyclable abrasives are also used with open nozzle blast cleaning in the field when containments are constructed to contain the abrasive and paint debris. The spent abrasive is transferred, typically by vacuuming, to an on-site recovery system that separates the waste and fines and returns the good abrasive for reuse. When using recycled abrasives in the field, a tight containment system with ample ventilation is required for three reasons: (1) to keep project emissions and waste from contaminating surrounding property, (2) to minimize abrasive loss to optimize the number of recycles achieved, and (3) to prevent unsightly spots of rust on surrounding surfaces caused by abrasive or metallic fines that escape containment and rust. These attributes of the containment are an added benefit of

using recyclable abrasives for the removal of lead paint. The abrasive itself helps to police the quality of the containment and the measures being taken to control lead emissions. If the property surrounding the project does not exhibit rust stains from the escape of abrasive or abrasive fines, it is a good indication that the lead has been controlled just as well.

While there are many advantages to using recyclable abrasives, if the surfaces are contaminated with grease, oil, or soluble salts, it is possible in extreme cases for the abrasives to become contaminated and spread the contaminant across the surface as the recycled abrasive continues to be used. The SSPC blast cleaning specifications require the removal of visible deposits of grease and oil before blast cleaning, but this is not always done, and the standards do not mandate prewashing the entire surface to remove salts. Because of this, it is critical that the tests required in SSPC-AB 2, *Cleanliness of Recycled Ferrous Metallic Abrasive* be conducted to assure that the abrasive is not contaminated. Tests for grease, oil, and water-soluble contaminants are conducted at 12-hour intervals, or every shift, whichever is shorter. The surface profile is also be measured to assure that it remains constant.

Another issue to consider is the method of salt removal that will be employed. Soluble salts are frequently removed by wet methods such as pressure washing, with or without a salt removal additive. The obvious concern

when using recycled abrasives is the introduction of water into a containment that is designed to keep water out to prevent the abrasive from rusting.

Expendable Abrasives

Expendable abrasives, rather than recyclable, are used with wet methods of preparation (water jetting or wet abrasive blast cleaning), and very commonly for dry nozzle blast cleaning. They are not used in vacuum blast systems or rotary wheel systems because of the lack of recyclability. The advantages of expendable abrasives include the low initial cost of the abrasive and the equipment needed to use it. The equipment required for expendable abrasives is also much more portable and flexible for use on small projects and for use at scattered locations across a plant site. Although the cost of the abrasive is less, since it is a one-time use, more of it is required and the volume of waste increases.

Although the blast cleaning specifications require removal of visible oil and grease before blast cleaning, when expendable abrasives are used, there is less concern with the abrasive becoming contaminated and spreading the grease, oil, or salt across the surface There is also no concern with the abrasive rounding, fracturing, or changing the shape, peak count, and depth of the

resulting profile. It will remain constant since the abrasive impacting the surface is always new. The effect of moisture on the abrasive is also much less of an issue and abrasive that may escape does not rust on the surrounding property.

Considerations when Selecting an Abrasive

When deciding whether expendable or recyclable abrasives should be used for a given job, the total cost must be considered. Items to assess include the size of the job, size and proximity of staging areas, costs of the abrasive, costs of the equipment needed to use it, differences in productivity, the volume of waste generated, costs of disposal, and the costs to erect and maintain the quality of containment needed for the work.

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