STEEL GRIT BLASTING IMPROVES PRODUCTIVITY AND QUALITY

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Abstract: *The Benefits of Steel Grit Blasting and Recycling* was presented at the 2017 SSPC Conference. The white paper detailed the advantages of blasting with steel grit to clean a surface, remove rust, create a surface profile, and prepare a surface for coating. As a continuation, *Steel Grit Blasting Improves Productivity and Quality* has been written to inform contractors the purity the steel grit holds and contains once blasted on a steel structure and recycled through a four-stage cleaning process. This paper will provide quantitative data gathered through laboratory testing that will prove steel grit blasting, recycling and cleaning produces a more consistent surface quality and has the highest return on investment.

INTRODUCTION

Abrasive blasting requires propelling a media outward onto a steel surface to prepare a surface for coating. Mineral abrasives, such as silica sand, coal slag, garnet sand, nickel slag and copper slag are blasted, turned to dust upon impact and disposed of. Steel grit can be recycled more than 100 times before it goes to waste, unlike other natural mineral abrasives. Since steel grit is recyclable, with the proper process, it can be cleaned near new condition between each pass or reuse. This is important because the recycling process assists in removing hazardous materials, such as lead and chlorides, which could lead to environmental issues or premature paint failure. This cleaning process results in a consistent and uniform surface preparation. By using steel grit along with a proper cleaning/recycling process, the contractor improves quality through decreased risks associated with coating failures and increases their disposal savings, productivity, logistics savings, and health and environment benefits.

OBJECTIVE 1: CONTAMINENTS CAN RESULT IN ENVIRONMENTAL ISSUES AND PREMATURE PAINT FAILURE

It is important that surface preparation is successfully executed before applying paint onto structures such as bridges, tanks and ships. A steel structure typically holds many contaminants that could affect the environment and the success rate of the paint (1). Once a media is blasted into the steel surface to remove the previous coating, the media now holds the contaminants from the removed coating and corrosion from the structure, which could be a hazardous release to the environment (1). If reused to blast with, the contaminates could be reintroduced onto the surface prior to refinishing (1). Two primary contaminates focused on in this publication is Lead and Chlorides.

Lead

In the past paints containing lead have been used for several decades, and about 70% of highway bridges use lead based paint because of its proven effectiveness (2). Throughout the years though, lead containing paints have proven to be toxic to people and the environment (2). Abrasive blasting workers are at the highest risk of lead exposure, and as a result OSHA has established many regulations and standards that help reduce employee exposure to lead (3). Also, to reduce employee exposure to lead, the SSPC created a standard that contains requirements for the cleanliness of steel grit (4). SSPC-AB2 requires a standard of <0.2% lead content (4).

Chloride

The primary cause of paint failure and structure deterioration is chlorides and other soluble salts (2). Chlorides become present on structures due to salt contaminants in the atmosphere and applications for snow/ice removal (5). Other sources of chloride contaminants are found on the abrasive material (6). If the contaminants are not removed, there may be loss of adhesion, blistering, and corrosion beneath a coated surface, resulting in coating failure (7).

OBJECTIVE 2: THE MATERIAL AND CLEANLINESS OF STEEL GRIT

Steel grit is manufactured in a controlled environment; thus, it naturally contains less contaminants than other abrasives, including natural minerals, before and after being blasted. The microstructure of high-carbon cast steel grit consists of tempered martensite, which holds a certain hardness range (8). The harder the grit, the more friable it becomes, which means grit will hold its sharp edges and remain an aggressive blasting media for multiple uses (8). Due to steel grits molecular compound, it can be blasted and recycled/cleaned continuously and added back into the work mix for a uniform blast profile. As steel grit breaks down to form a balance operating working mix, the performance of grit is analyzed by NACE and SSPC cleanliness standards.

Surface preparation accounts for 40% of the cost associated with repainting a job, thus contractors and facility owners need to carefully analyze the material they are blasting with (9). Sophisticated processes and technology exists allowing the greatest results with steel grit. A contractor initially has three options once choosing an abrasive media;

1.) A contractor can blast a steel structure once with signal use abrasive and dispose of the media, removed coatings and corrosion.
    a. This is most of non-recyclable abrasives.
2.) A contractor can blast a steel structure once with signal use abrasive and dispose of the media, removed coatings and corrosion.
    a. This would reintroduce contaminant back into the surface.
3.) A contractor can blast a steel structure once with signal use abrasive and dispose of the media, removed coatings and corrosion
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Once a contractor decides to use steel grit and recycle it through a cleaning process, he/she has gained benefits that do not exist when blasting with mineral aggregate. Benefits to using steel grit include steel grits 99% recyclability rate and its non-fracturing, dustless media properties. Overall recycling steel grit creates a large abrasive cost reduction, disposal savings, productivity increases, labor cost savings, and less employee exposure to toxins.

OBJECTIVE 3: STEEL GRIT IS RECYCABLE WHICH CREATES A LARGE COST SAVINGS

The cost savings associated with using steel grit are predominantly derived from the recyclability rate steel grit can uphold. Steel grit would not maintain its quality and cleanliness after being blasted without going through a proper recycling and cleaning process. With the right technology, steel grit will be thoroughly cleaned within a four-stage recycling process: beginning at stage one in the recycler, the baghouse collection and end at stage four, the multi-stage air wash station.

Laboratory results show that with the proper technology, throughout a four-stage recycling and cleaning process, dirty grit is cleaned to meet cleanliness standards, including SSPC-AB2, where the abrasive must contain <0.2% lead content by weight. The tests described below not only concludes that lead levels are acceptable after recycling and cleaning, but chloride levels are also decreased. Some recycling machines stop the cleaning process at the cyclonic separation, which results in failing to meet AB2 and may be reintroducing contaminates back into the blasted surface.

Test 1

Two samples of steel grit have been tested in a certified laboratory to measure the total lead and chloride content. The results determine the amounts of contaminants in new steel grit (aka Clean Grit), compared to grit blasted onto a steel surface with 10-15 mils of lead based paint, then picked up off the contaminant floor (aka Dirty Grit).

Test 1		
	Contaminants	
Steel Grit Sample	*Lead*	*Chloride*
Clean Grit	0.00428%	0.0015%
Dirty Grit	0.638%	0.00288%

Measured in percent by weight

In Test 1, dirty grit has signifcantly higher lead levels than the new grit. Dirty grit fails to meet AB2 standards by three times the amount, with a total lead content of .638%, yet many contractors blast with dirty steel grit because they do not have a proper recycling and cleaning method.

Initially clean grit had 15 mg/kg (0.0015%) of choloride, but after it was blasted on a steel structure, the sample contained 28.8 mg/kg (0.00288%) of chloride.

Test 2

Samples of steel grit has been tested in a certified laboratory to test for total lead and chloride content. This steel grit is the same steel grit found in Test 1: Dirty Grit, but has gone through a four-stage cleaning process beginning with a baghouse collection and ending in a multi-stage air wash station. This sample will be known as recycled grit.

Test 2		
	Contaminants	
Steel Grit Sample	*Lead*	*Chloride*
Recycled Steel Grit	0.114%	0.0015%

Measured in percent by weight

Many points are provided from the data collected from Test 2. After steel grit has gone through a proper cleaning/recycling process, lead and chloride levels are greatly decreased compared to the levels of lead and chloride found in dirty grit. Lead levels surpassed SSPC-AB2 standards, with a lead content level of 0.114%. The cleaning process decreased lead levels by 5,240 mg/kg or 82%. This means that the specific recycling process that cleaned the dirty grit in Test 2 is truly cleaning it. Removing the contaminates from the steel grit has a positive impact to the environment by minimizing the amount of hazardous waste sent for disposal.

The amount of chlorides detected in recycled steel grit reduced greatly between dirty grit after recycling. Chloride ions are being cleaned off the steel grit through the recycling process, resulting in a cleaner finished blast surface.

OBJECTIVE 4: IT IS PROVEN THAT STEEL GRIT RECYCLING RESULTS IN THE MOST BENEFITS TO THE CONTRACTOR

Test 3

Three steel plates were used to blast on, new clean grit, dirty grit and cleaned/recycled grit. The steel plates are approximately 3x3 inches, mill scale was present and the three plates were solvent cleaned before blasting with a psi of 90. Ghost wipes were then used to wipe each plate to test the lead levels each steel grit sample imbedded into the steel plate. The ghost wipes were then sealed and brought to a certified testing laboratory. Below details test 3 results:

Test 3	
	Contaminant
Steel Grit Sample	*Lead*
Clean Grit	201
Dirty Grit	1550
Recycled Grit	653

Measured in ug per sample

Each steel plate resembles a steel structure. Test 3 results indicate that recycled steel grit is cleaned well enough to blast at similar quality levels to virgin grit, thereby not reintroducing the removed contaminants back into the blasted steel. This puts the contractor at a disadvantage because he/she is enabling more hazard pollutants into the air and he/she will not take any cost saving benefits that result from using a proper cleaning/recycling system.

Conclusion

The laboratory results show that steel grit recycling and cleaning drastically reduces contaminant levels on the abrasive. Clean grit initially has a small amount of lead and chloride in the media, but once blasted on a steel surface, the abrasive is highly contaminated. It takes a proper cleaning/recycling process to reduce these levels. Below is an overview of the three samples tested, demonstrating the amount of lead and chloride in the abrasive.

Comparing Test 1 and 2		
	Contaminants	
Steel Grit Sample	*Lead*	*Chloride*
Clean Grit	0.00428%	0.0015%
Dirty Grit	0.638%	0.00288%
Recycled Steel Grit	0.114%	0.00146%

Measured in percent by weight

Out of all abrasive blasting medias and methods, it has been justified that steel grit blasting and recycling with a proper four stage cleaning/recycling process, produces the most cost savings for contractors. It has previously been detailed in *The Benefits of Steel Grit Blasting and Recycling* that a contractor can save 81% on their abrasive, disposal and labor costs. Now, *Steel Grit Blasting Improves Productivity and Quality* enhances the benefits by adding quantitative data to steel grit cleaning/recycling. With a four-stage cleaning/recycling process, steel grit cleans contaminants that could result in environment issues and premature paint failure. In the long run, the continuous removal of contaminants, such as lead and chloride throughout the cleaning/recycling process, improves productivity and quality of the surface profile, which allows for a higher cost savings.

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