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Steel Grit for Surface Prep: Reducing the Risk of Coating Failure

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By Iann Bouchard, Eng, Winoa USA

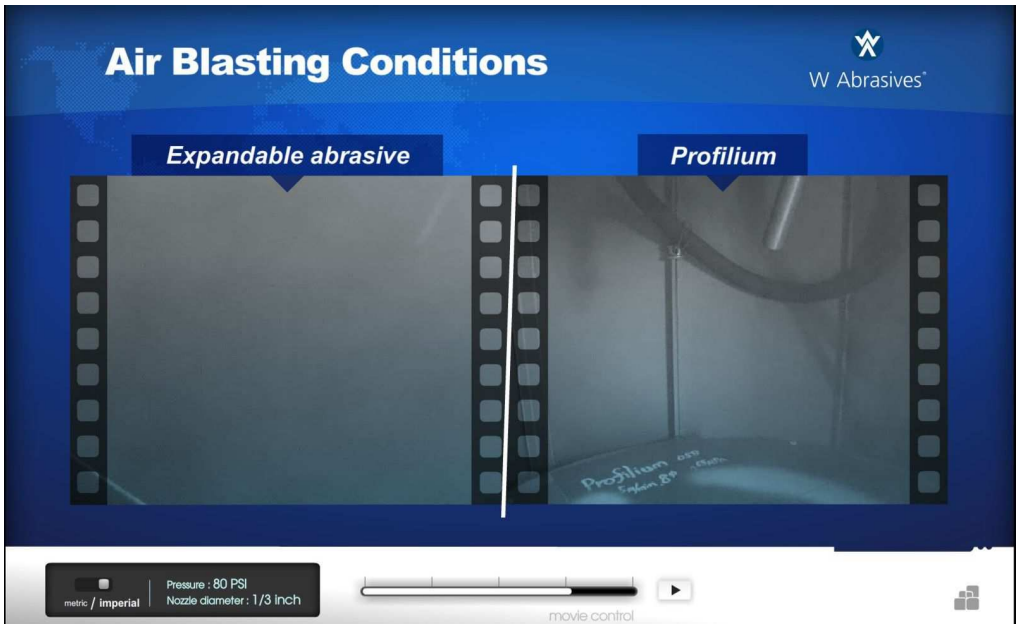
About 75 percent of coating failures can be attributed to improper or ineffective surface preparation. Most wheelblast machines and airblast recycling systems use steel shot or grit as cleaning media, but the perceived simplicity of the cleaning process can be misleading.

Here are some best practices that will improve blasting speed, reduce coating failures and lower the total preparation costs.

- Select the proper abrasive for your application.
- Work with high-efficiency media.
- Maintain a good, clean operating mix.
- Reduce soluble salt (chlorides) contamination.
- Create and monitor the proper surface profile.

Following are a few main advantages to using steel abrasives instead of expandable abrasives. They:

- can be recycled hundreds to thousands of time, reducing media costs;
- have a low breakdown rate, reducing waste and dust quantity, and improving blaster visibility;
- have high density and mass (weight) which yield the best transferred energy (300+ pounds per cubic feet vs 100 pounds per cubic feet for sand);
- can be hard and angular for a cresting profile or soft and round for scale and rust removal;
- are safe, clean and contain no hazardous material, such as asbestos and silica.

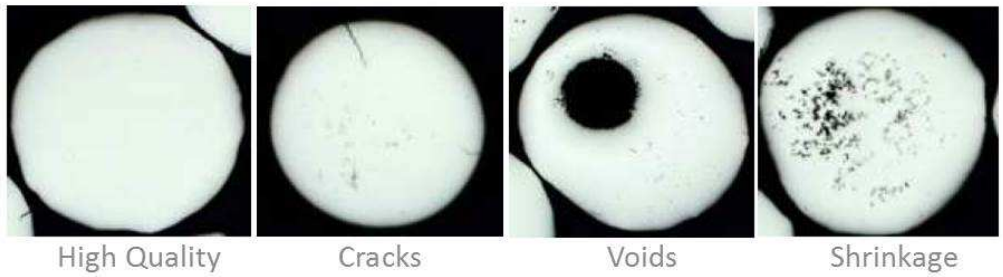


Example of dust condition in airblast room using copper slag (left) vs steel grit (right) at 80 psig.

SELECTING THE PROPER STEEL ABRASIVE

The size, hardness, shape and quality of an abrasive are all important factors that affect the efficiency and outcome of a surface preparation job. Manufacturing steel abrasive consists of melting recycled steel, putting it through an atomization process, then using air-quenching technology to support a highly controlled heat treatment process that minimizes defects. Careful control of these steps ensures high-quality, durability and consistency in the abrasive product.

While guidelines for cracks, voids, shape, density, microstructure and dust are all included in SAE J827, acceptable limits for defective shot can reach 55 percent. Some abrasive manufacturers, such as W Abrasives, develop their own, more stringent specifications to ensure long-lasting media life.



Example of defects in steel shots.

Basic rules in selecting the best-size abrasives:

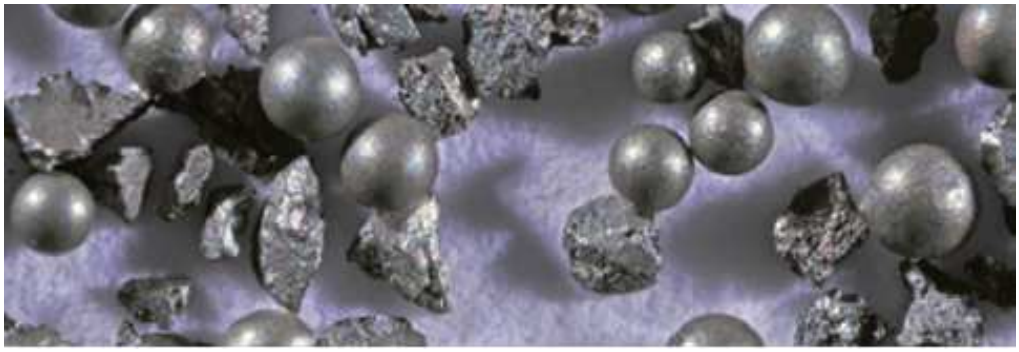
- Impact, energy and coverage are important ingredients to ensure a highly effective blasting process;
- The media must be large enough that impact energy will remove all contaminants (energy in function of throwing velocity and mass); and
- It must be small enough to provide the best coverage for a nice cleaning action (more particles per pound = more impacts per minute).

Finally, the type (shot, grit or angular shot), hardness (available between 40 to 65 HRc+) and shape are all other selection factors that your abrasive supplier can help you with.

Relative newcomers to the market are high-efficiency steel blasting media, products that increase cleaning speed while reducing abrasive consumption. They also increase surface profile consistency and create cleaner parts.

As an example, the Stainium product line, used in wheelblast machines, can improve cleaning

performance up to 20 percent and reduce residual dust up to 15 percent compared with commonly used steel media. The Profilium line is adapted for airblasting, specially produced to help maintain an efficient operating mix. It is more aggressive and productive than a regular GL product but maintains comparable media consumption.

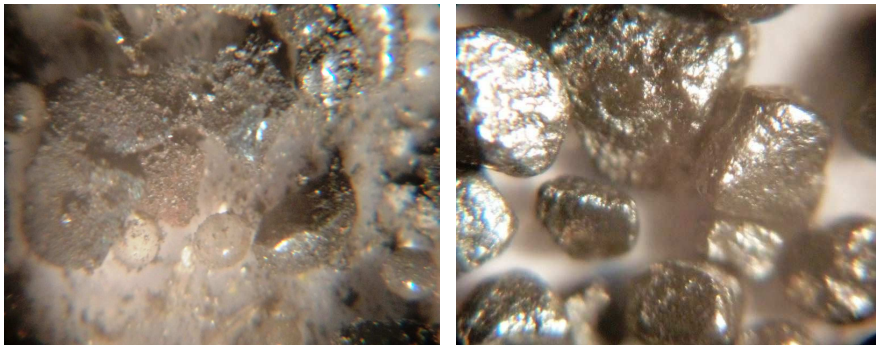


Stainium is a high-performance steel abrasive for surface preparation.

The optimal way to select the right media type, size and hardness is to run trials. Some abrasive manufacturers can replicate your actual airblast or wheelblast machine parameters while testing multiple abrasive selections using your actual parts. The main advantage of running trials is to achieve optimal abrasive selection and performance — the first time — without disrupting the actual production process. Winoa runs six such test centers for this purpose.

MAINTAINING AN EFFICIENT AIRWASH SYSTEM FOR A GOOD, CLEAN OPERATING MIX

Once the best media for your application has been selected, its size distribution in the operating mix (OM) is critical to the sustainability of the surface finish and cleanliness. A poorly controlled OM that contains dust, scale, detritus and other unwanted debris will be detrimental to your blasting performance and will also impact coating performances. So it's important to maintain clean media and a nice distribution of large particles for impact, and medium and small particles for the coverage to remove lighter contamination and to clean small crevices and pits. While the abrasive cleaning system (often made of an airwash or cyclone type separator) is sometimes forgotten, it is the lungs of a good system.

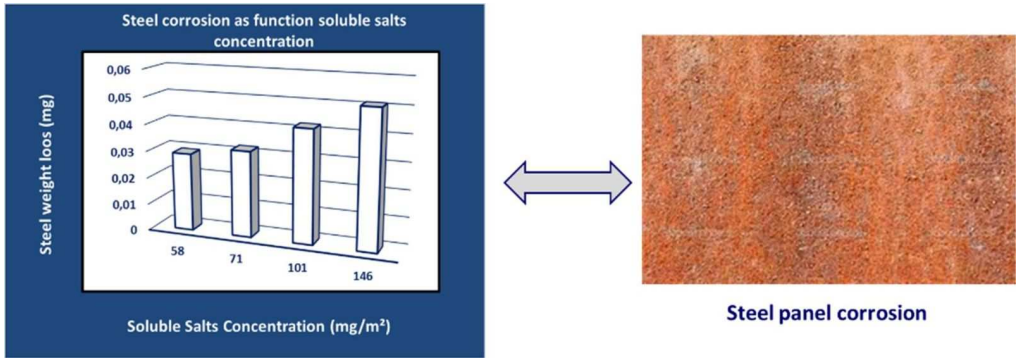


Example of a non-efficient abrasive cleaning adjustment, resulting in a contaminated operating mix *(left);* a clean OM is shown, *right.*

Support and training from experts in the field is key to meeting your project goals. To achieve optimal blasting parameters, use only equipment from qualified technicians and maintain your blasting process properly.

REDUCE SOLUBLE SALT (CHLORIDE) CONTAMINATION

The presence of soluble salts (mostly chlorides and sulfates) at the steel/paint interface is known to have a detrimental effect on coating life. Abrasive conductivity is a measure of the concentration of the total water-soluble ions in the abrasive. This media contamination can be transferred to the blasted surfaces, accelerating corrosion (ASTM D4940) and resulting in catastrophic failures.



By international standards, the maximum permitted value of soluble salt concentration is 1000 µS/cm; however, it is not unusual to see industrial requirements of 50 µS/cm in demanding environments. Sometimes, in the case of a very harmful salt, the exact chloride content is specified (in mg/l or ppm).

Non-metallic abrasives typically have high amounts of chlorides, ranging between 250 µS/cm to 750 µS/cm or even higher. Typically, high carbon steel shots and grits will have lower values depending on their manufacturing process. The high-quality steel media manufacturers will normally have conductivity around 100 µS/cm, five times lower than expandable abrasives.

The air-quenching process used by W Abrasives achieves conductivity levels at or lower than 30µS/cm — significantly below the ASTM D4940 low-level value of 50µS/cm. This ensures the safest possible use for salt contamination.

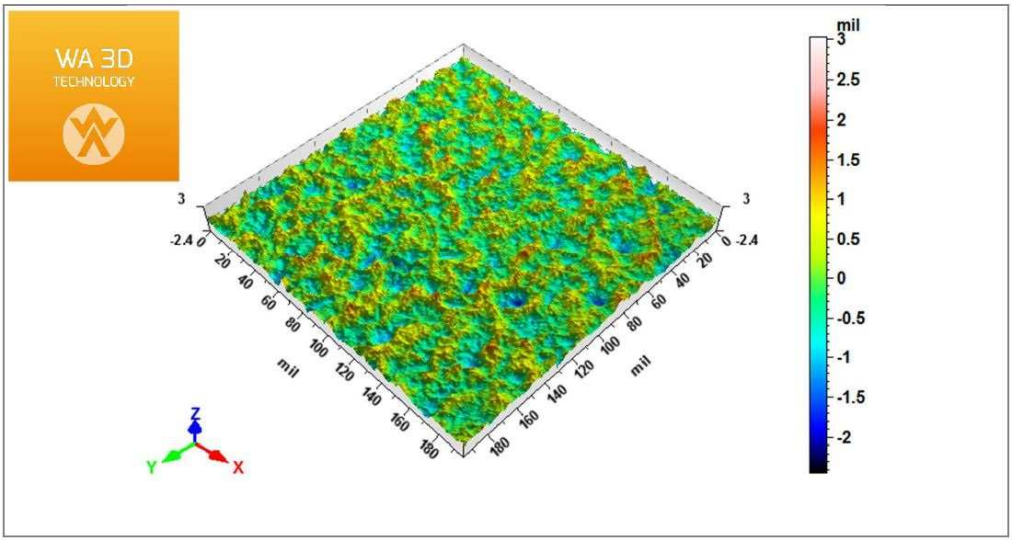
Typical example of detrimental effects of soluble salts under a coating system (surface corrosion). Osmotic blistering *(left);* loss of adhesion due to underfilm corrosion *(right).*

OPTIMIZING THE SURFACE PROFILE:

The roughness, anchor pattern, peak quantity and profile were, for a long time, evaluated using tactile reference comparators (ISO 8503-1). While Testex gauges, portable surface roughness testers and simple stylus instruments are all commonly used, it is now also possible to visualize the roughness profile of a blasted surface in the form of a 3D representation. Called WA 3D at Winoa, this technology opens up the possibility of using roughness parameters that were inaccessible until now. It produces the equivalent of 2500 profiles obtained with a contact stylus instrument.

The main advantages: More information about the surface morphology is provided and void volumns are measured more precisely to evaluate paint consumption of different media. A more in-depth evaluation of the Rsk (the degree of skew) and Rku (sharpness of a surface) also provides and ensures good coating-adhesion strength properties.

3D SURFACE TEXTURE – 1



CONCLUSION

The conditions of the substrate, as stated in ISO 8502, will irremediably affect the behavior of a protective coating system. But the selection of a high-quality steel abrasive and service partner will help you reduce surface contamination and improve surface cleanliness and profile properties to ensure minimal risk of coating failure and reduce your total operating costs.

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ABOUT THE AUTHOR
Iann Bouchard, Eng, Winoa USA

Iann Bouchard is product and marketing zone manager at W Abrasives, Winoa USA. His passion for helping his customers solve cleaning problems and improve blasting efficiency has led him to support sales, products, marketing and service at W Abrasives over the last four years. Bouchard's expertise from Wheelabrator and his studies in engineering have allowed him to understand the challenges faced by the industry.

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