WASHINGTON MILLS

BETTER BLASTING

The oil and gas industry is increasingly looking to aluminum oxide for improved coating adhesion and performance.

Pipes and other associated drilling equipment for the oil and gas industry must be able to operate under challenging conditions, including demanding environments, abrasive wear and the flow of corrosive materials. Properly applied coatings—both internal and external—provide protection against these factors, helping maintain optimal flow while extending the life of the pipe and equipment.

Surface preparation plays a vital role in ensuring a coating's effectiveness and efficiency. The objective of surface preparation is to facilitate the adhesion of a coating on the equipment. The level of adhesion determines whether the coating is just a thin film lying on the surface, or if it is able to offer effective protection by becoming part of the substrate. The coating cannot adhere properly if the surface is not well prepared, and the result is often costly and time-consuming equipment failure.

Grit Blasting Overview

Grit blasting with coarse abrasive particles is a common method of surface preparation for coatings that require both an anchor pattern and a high degree of surface cleanliness. Surface preparation with grit blasting increases the roughness of the surfaces as well as the coating's adhesion strength. Blast cleaning is also the only method that can completely remove intact rust and mill scale and produce an even roughness with a controlled anchor pattern.

Most grit blasting users seek what is called a working mix of grit sizes, which means that they want a mix of differently sized grit rather than one single grit size. Working the surface with different grit sizes maximizes blasting efficiencies since different sizes do different things to the profile. The working mix used depends on the unique profile that the user is looking to create on the surface. One user may want to create a smoother profile while another may want to create a rougher profile. The grit sizes can thus be targeted to have a specific impact on the required profile.

Steel shot is a material that is commonly used in surface finishing because it is long lasting, but it does have a few drawbacks. Most importantly, it can produce flash rust, particularly in moist conditions. If rust is left on the surface when the coating is applied, that rust can corrode and cause the coating to fail. In addition, steel shot loses its shape and rounds out as it breaks down over time, leading to inconsistent profile characteristics on the surface. If the profile is not uniform, the coating may suffer from poor adhesion.

Aluminum Oxide

While traditional grit blasting media like steel shot is still prevalent, the industry is increasingly looking to alternative materials like aluminum oxide for improved coating adhesion and performance. Fused brown aluminum oxide is an abrasive material that exhibits superior abrasion properties, as well as high corrosion and chemical resistance (see Table 1). It is typically available in macro grit sizes ranging from 12 to 240 grit, and it is also low in iron so it leaves behind no impingements that can leave rust on the surface and cause potential problems in the future (see Table 2).

According to a representative from a company that produces thermal spray coatings for the oil and gas industry,

other materials are not able to match aluminum oxide's performance. "We've tried everything, and aluminum oxide works best," he says. Aluminum oxide is "very hard and fairly inexpensive. On impact, we need it to create a rough profile—not just to clean like sandblasting, but to actually create little indentations in the surface."

Quality is key, however, as low-cost, low-quality aluminum oxide doesn't typically pay off in the long run. "We can buy material made in Brazil or China cheaper, but then we use more so it's not cost-effective," he explains. "It produces lots of dust, which is detrimental. It doesn't have enough size or mass to create a good impact, so it just blows out in the air. Also, the hardness, or robustness, of the individual particles of [high-quality] aluminum oxide is superior to the others. The others, when they hit the pipe surface, they just tend to shatter, as opposed to embedding and ricocheting to create the best profile."

An additional benefit offered by aluminum oxide is that, unlike steel shot and other grit blasting materials, it can be reclaimed and recycled back to the aluminum oxide manufacturer. Most large-scale blasting operations have an indoor or outdoor system that collects the spent grit. Washington Mills is North America's only manufacturer of aluminum oxide that offers a completely closed-loop, waste-free spent aluminum oxide grit recycling system. Washington Mills will pick up the spent grit from the company's grit blasting operation and use it in its furnaces in order to produce fused aluminum oxide that is identical to virgin material.1 The possibility of closed loop recycling that reduces disposal costs, as well as liabilities, makes aluminum oxide a very attractive blasting material.

A New Alternative

The oil and gas industry depends on reliable coatings to protect its pipes and drilling equipment. Without effective surface preparation, these coatings can suffer from poor adhesion that leads to poor performance or even pipe/equipment failure.

Aluminum oxide's excellent hardness, strength, and corrosion resistance make it an ideal material for grit blasting applications. The material can also be incorporated directly into coatings to improve their durability and corrosion resistance.

For additional information regarding the benefits of brown fused aluminum oxide, contact Washington Mills at (716) 278-6600, email info@washingtonmills.com or visit www.washingtonmills.com.

Table 1. Typical physical properties

Crystallography	Alpha alumina, in a hexagonal crystal
Color	Brown
Specific gravity	3.92
$Knoop_{100}$ hardness	2050
Shape	Blocky with sharp edges
Ball mill friability	50 (14 grit)
Grading (grain)	ANSI B74.12-2001, Table 3
Bulk density (grain)	ANSI B74.4-1992 (R2007)

Table 2. Typical chemical analysis

Al_2O_3 (by difference)	96.00
TiO_2	2.70
SiO_2	0.70
Fe_2O_3	0.15
CaO	0.15
MgO	0.30

Reference

1. McLeod, Don, "Recycling Spent Aluminum Oxide," *Ceramic Industry*, October 2008, pp. 29-31.