

Improved coating adhesion with aluminium oxide

Pipeline coating technology is of considerable importance to the international industry, helping maintain flow while extending the life of the pipeline. Properly applied coatings – both internal and external – enable pipelines to operate efficiently under challenging conditions and environments. Continued advances in coating technology are equally important, and industry is increasingly looking to aluminium oxide for improved coating adhesion and performance.

Surface preparation plays a vital role in ensuring a coating's performance. The objective of surface preparation is to facilitate the adhesion of the coating, the level of adhesion of which 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. If the surface is not properly prepared, the coating cannot be applied correctly, which will only cost more time and money down the track once the equipment fails.

Common surface preparation

Grit blasting with coarse abrasive particles is a common method for surface preparation that requires both an anchor pattern on the pipe's surface and a high degree of surface cleanliness. Correct surface preparation by grit blasting increases the roughness of the surface as well as the coating's subsequent adhesion strength.

Grit blasting is also the only method that can completely remove all intact rust and millscale, and produce an even roughness with a controlled anchor pattern.

Most grit blasting users like to use a working mix of grit sizes. This means that they seek a mix of different sized grits, rather than one single grit size. Grit blasting with different grit sizes maximises blasting efficiencies, since different sizes have different impacts on the surface profile. The working mix used depends on the specific profile that the user is looking to create – one user might want to create a smoother profile, while another may want to create a rougher profile.

Steel shot is a long-lasting abrasive, and is commonly used in surface finishing, but it does have some disadvantages. Among these is the fact that it can produce flash rust, particularly in moist conditions, and this can cause the coating to fail if the

flash rust is left on the surface. In addition, steel shot loses its shape and 'rounds-out' as it breaks down over time, leading to inconsistent characteristics on the surface. So if the profile is not constant throughout, the adhesion of the coating may suffer as a result.

A performance-enhancing alternative

While traditional grit blasting media such as steel shot is commonly used, the industry is also looking at alternative materials, such as aluminium oxide, for improved coating adhesion. Fused brown aluminium oxide is an abrasive material with excellent abrasion properties, as well as high corrosion and chemical resistance (see Table 1). It is typically available in macro grit sizes ranging from 12–240 grit. As it is low in iron, it leaves no rust on the surface which could cause potential problems in the future (see

Table 1: Typical physical properties of aluminium oxide

Crystallography	Alpha alumina, in a hexagonal crystal
Colour	Brown
Specific gravity	3.92
Knoop ₁₀₀ hardness	2050
Shape	Blocky with sharp edges
Grading (grain)	ANSI B74. 12-2001
Bulk density (grain)	ANSI B74.4-1992 (R2007)

Table 2: Typical chemical analysis

Al ₂ O ₃ (by difference)	96.00 %
TiO ₂	2.70 %
SiO ₂	0.70 %
Fe ₂ O ₃	0.15 %
CaO	0.15 %
MgO	0.30 %

Table 2). The material is also hard and relatively inexpensive; it is available in various hardnesses, although the ‘softer’ grades are unsuitable for grit blasting as they can shatter and produce dust which is not only ineffective but is detrimental to the coating process.

An additional benefit offered by aluminium oxide is that, unlike steel shot and other grit blasting materials, it can be reclaimed and recycled back to the

aluminium oxide manufacturer, and most large-scale blasting operations systems collect the spent grit for this purpose. US-based Washington Mills, has developed a 100 per cent closed-loop, waste-free, spent aluminium oxide grit recycling system. The

company collects spent grit and uses it to produce fused aluminium oxide. This closed-loop recycling process reduces disposal costs, liabilities and – the company claims – makes its aluminium oxide a very attractive blasting material. ♦

For additional information regarding the benefits of brown fused aluminium oxide, contact Washington Mills at +1 (800) 828 1666, email info@washingtonmills.com or visit www.washingtonmills.com

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