Choosing the right surface preparation process is the first hurdle to overcome

Extending the life and applicability of materials through the application of coatings is an old engineering trick. Steed Webzell provides an update on the latest technologies

Scratching

It goes without saying that coating components is far more cost effective than using exotic materials or accepting a need to replace them as they wear down. However, selecting the right coating and choosing the optimum surface preparation process are not always so clear cut.

"The products being manufactured, the materials and process steps and the equipment to be used all need to be taken into account," advises Jonathan McGargle of the Abrasives Division at 3M. "It is also vital to consider: the tasks to be performed by the abrasive products; the level of usage; and operator exposure to vibration," he says. And he adds in other aspects, such as quality, rejects, productivity, cost and operator welfare, as well as constraints with either the workpieces or the processes.

For low numbers of components with fairly simple geometry, hand-held and power tool abrasives often provide the most cost-effective route to surface preparation. For greater numbers of components, or for parts with difficult-to-access features, blasting is the more common route.

For the uninitiated, shot blasting can appear a messy, unpleasant process that's both inflexible and difficult to control. And yet nothing could be further from the truth. All that is needed is a little knowledge, and shotblast equipment supplier Guyson is offering help, with a free fact sheet featuring 10 top tips.

The first three tips on the list are: choose the least aggressive media that will do the work – this will result in less wear and lower equipment maintenance expense; use the smallest media particle size – more impacts per second will yield a faster process; and find the lowest blast pressure – this offers the benefits of energy savings in reduced compressed air requirement, as well as less wear and lower maintenance costs.

Interestingly, Guyson has recently installed several robotic capabilities at its Skipton demonstration and engineering centre to assist plant engineers with process evaluation and blasting simulation. Using newly installed CAD/CAM software, Guyson's engineers are now able to take an STP [STEP CAD program] file of the component that requires blast finishing and produce accurate 3D simulations of the blast treatment on the component, showing actual blast cone coverage for all critical areas.

But what if the component cannot be moved or there is no, or insufficient, compressed air to do the job? To answer these common dilemmas, Hodge Clemco has introduced a range of IBIX portable blast machines, targeted at the offshore, marine and petrochemical industries, as well as smaller operators where air availability may be limited and portability and weight are key. These feature a lightweight aluminium construction, trolley and/or backpack style carriage and simple pistol operation to help plant engineers where site access is difficult.

Incidentally, Hodge Clemco has also introduced a new blast suit that meets international standards for wet and dry abrasive blasting operations. Developed with Shell and major maintenance contractors in the petrochemical sector, the suit is the first to meet EN ISO 11612:2008 (clothing for protection against heat and flame) and EN ISO 14877:2002 (protective clothing for blasting with granular abrasives), allowing it to be used at onshore and offshore petrochemical plants and in zoned environments.

For busy plant engineers, another option is to subcontract blasting operations, which eliminates the

Coatings for composites

Much of the traditional coatings market is designed to protect metal components. However, such is the growth in composite materials that a new generation of coatings is emerging to meet surging demand.

A case in point is an anti-wear and anti-abrasion surface technology from Zircotec designed to protect composites. By applying a 0.4mm layer of bond coat and molybdenum, tungsten or stainless steel to a substrate, lightweight composite materials can now be used safely in harsh, abrasive environments, according to the company. This provides clear weight and durability benefits over traditional materials.

That changes everything: until now, the use of composites in high-wear environments was restricted by safety concerns, the need for heavy shielding or a requirement to continually replace abraded surface sections. The costs to do the latter meant that any advantages composites could offer were only available in niche sectors, such as motorsport, where Zircotec's new coating was, in fact, developed and tested.

Zircotec's new range of metal coatings now offers anti-wear, anti-abrasion, EMC and anti-heat protection properties. The coatings are applied using a derivative of the firm's plasma spraying process, employed typically to apply heat-resistant ceramics to components. The process protects the composite during application of the proprietary bond and top coats. Zircotec has also developed a bespoke masking capability, ensuring that only the required elements are coated. That reduces cost and unnecessary weight – a factor sure to capture the imagination of plant engineers everywhere.

the surface

process expertise requirement and capital equipment costs. The wet process available from Vapormatt, for instance, provides for concurrent degreasing and blasting. The company also claims to offer reduced operations and costs, and adds that automation can cut surface preparation prices further.

It's a wrap

So, the surface is prepared. What next? Well, there are a myriad of coating options. Weld overlay cladding, for example, has applications in the oil, gas, naval, marine, nuclear and chemical industries, protecting wetted and/or wear surfaces.

Arc Energy Resources is one firm specialising in weld overlay cladding, as Woking-based Subsea Riser Products (SRP) can testify. Two recent projects involved cladding more than eighty 24-inch, heavy-walled flanges, weighing 1.6 tonnes each. The components were for use on high pressure drilling risers destined for projects in the North Sea. Arc Energy applied a corrosion-resistant 625 Nickel alloy to the flange sealing pockets.

Like the offshore oil sector, power generation plants can also benefit from coatings that help protect the life of expensive components. Take gas turbine blades, which are manufactured from exotic materials, and require costly casting and machining.

Increasing their durability and resistance to erosion from hard particles and high-speed water droplets is an ambition of all power plant engineers. Longer lasting turbine blades result in serious cost savings, as blades are expensive. Also, replacement requires costly shutdown time.

However, in this case, improving durability and erosion resistance is not feasible using traditional methods, such as titanium nitride (TiN) or thermal spray tungsten carbide. Coatings specialist Hardide claims that TiN and equivalent thermal spray coatings both lead to only limited improvement in part life. The reason? TiN is too thin – usually no more than 4 microns – while thermal spray is not as resistant to droplet erosion.

Tests performed on a new Hardide coating applied to steel and titanium substrates show better results. Droplet erosion resistance was estimated to approach that of TiN, but Hardide can be up to 25 times thicker. According to Hardide, turbine blades are just the tip of the engineering iceberg. PE

Pointers

- Choosing the right process and coating is not just about the materials
- Products, their function, process steps, quality and production rates all matter
- Shot blasting remains a key process, with simple rules making it highly effective in most cases
- Portable machines are also available, for wet and dry blasting
- Weld overlay cladding, titanium nitride and thermal spray tungsten carbide are effective, but developing
- Key new technologies are aimed at coating composite materials for tough tasks