Surface Coating Technologies Cuts Time, Saves Money

As Benjamin Franklin once said, "time is money." Hardly anywhere is this more applicable than in the oil and gas industry, where time on the job can quickly become money down the drain if wells are not delivered efficiently.

With increased interest in unconventional operations, such as lateral and directional drilling, along with exploration and production in extreme environments like deep and ultra-deepwater, the industry faces new challenges, thus necessitating new technologies and coatings to make tools withstand difficult conditions. Operators are always on the lookout for tools to improve the rate of penetration (ROP), therefore minimizing the number of days spent on wells and lowering overall authority for expenditure (AFE).

Driven by these needs, surface technology companies are supporting this industry and are designing new and improved applications to overcome the extreme conditions found in the field. Specifically for drilling operations and downstream pipeline construction, there are a number of coating technologies that are dramatically extending the life of drilling products, which ultimately reduces downtime. A couple of these are now widely used in the oil and gas industry: thermal spray (specifically high velocity oxy-fuel coating spraying (HVOF)), and welded overlays. To select the most beneficial technology for any given application, it is vital that project managers understand the differences between them, as well as the in-service environmental conditions and tribological factors, including friction, lubrication and wear.

How surface coating technology minimizes non-productive time (NPT)

When setting out on a new drilling project, oil and gas project managers have one clear goal in mind - complete the project without interruption. Any unscheduled downtime will result in losses amounting anywhere from tens to hundreds of thousands of dollars, and unfortunately, equipment damage and failure are regularly the cause of such incidents.

Surface coating minimizes equipment damage and related NPT. By applying the appropriate coatings to key parts, such as mud rotors, drill

Tricone bits are protected by using abrasion-resistant and slurry erosion resistant carbide materials PTA and laser cladding blend materials or oxy-acetylene hard face welding products.

mandrels, stabilizers and valves, operators improve equipment performance and realize improved durability over traditional manufacturing processes, such as manual metal arc (MMA) welding and hard chrome plating (HCP). By reducing the likelihood of breakdown, and therefore the need for an equipment changeover, project managers can be confident that their drilling crews continue working without equipment-related delays.

Operators rely on original equipment manufacturers (OEM) to supply durable equipment that will withstand the variety of stresses placed on tools. Because thermal spray results in a mechanical bond between the coating and substrate, this application offers the equipment OEMs the optimal corrosion protection for parts that have no impact exposure, such as bearings and pump seal faces, valve parts and shafts. Thermal spray produces a very thin overlay, making product finishing easier and faster compared to welding parts.

Additionally, the mechanical bond that is formed during this coating process withstands the extreme conditions found in some wellbores. For example, mud rotors treated with a thermal spray coating often have a service-life ten times longer than those treated with HCP. Unlike welded coatings, thermal spray can be used to apply oxide ceramic coatings which withstand high mechanical strength (300 to 630 MPa), are resistant to corrosion and wear, and have excellent gliding properties. An example of this for oil and gas would be riser tensioners on offshore platforms. The porosity levels of thermal sprays have now been lowered to less than 1 percent, in many cases less than 0.5 percent, making them close to fully dense.

Welding: Coating applications in high-pressure/high-temperature (HP/HT) environments

For equipment used in high-pressure and/or high-temperature (HP/HT) environments, welding is often the preferred method. In contrast to thermal spray's mechanical bond, welding melts both the material being applied

Abrasion and corrosion-resistant carbide materials extend the lifetime of drill collars.

and the surface of the substrate, forming a durable metallurgical bond. This is necessary for tools exposed to extreme conditions that cause heavy wear and tear. In particular, HP/HT environments often found in deep-water operations require Laser Cladding to produce a fully dense coating, without which the equipment can quickly become damaged and require downtime for repair.

Within welding itself there are variations, namely metal inert gas (MIG) welding, plasma transferred arc (PTA) welding and Laser Cladding. MIG is a common welding process for indoor environments (though rarely used outdoors or in other areas of air volatility) due to the speed and ease with which it can be adapted to robotic automation. However PTA deposits are tougher and more corrosion resistant, making them more suitable to harsh underwater environments. Laser Cladding is commonly used to improve mechanical properties or increase corrosion resistance, repair worn out parts, and fabricate metal matrix composites. Both Laser Cladding and PTA are the most 'popular' of the methods, and both easily outstrip the performance of MIG welding. In addition, Laser Cladding and has gained further use as a complementary coating technology to thermal spray.

Conclusion

Each of these effective surface solutions has benefits, but which method a manufacturer uses must be wholly dependent on three key factors:

1. the type of material being coated
2. operating conditions like high stress, impact or sliding wear, and corrosive media
3. geology

In the oil field, the lithology of the formation being drilled can vary greatly. That is why it is important to select a supplier with a broad portfolio of coating materials and technologies to ensure the selection of the most beneficial one for the project.

An example is Oerlikon Metco's Coatings Solutions Center (CSC), a global resource that advises manufacturers on any of the above solutions – and more – to make sure they have the correct technology for use in their specific situation. Additionally, manufacturers need experts on hand to discuss the project's needs as well as infiltration processing to increase the operator's return on capital employed (ROCE). Time may be money, but partnerships can bring profitability. •

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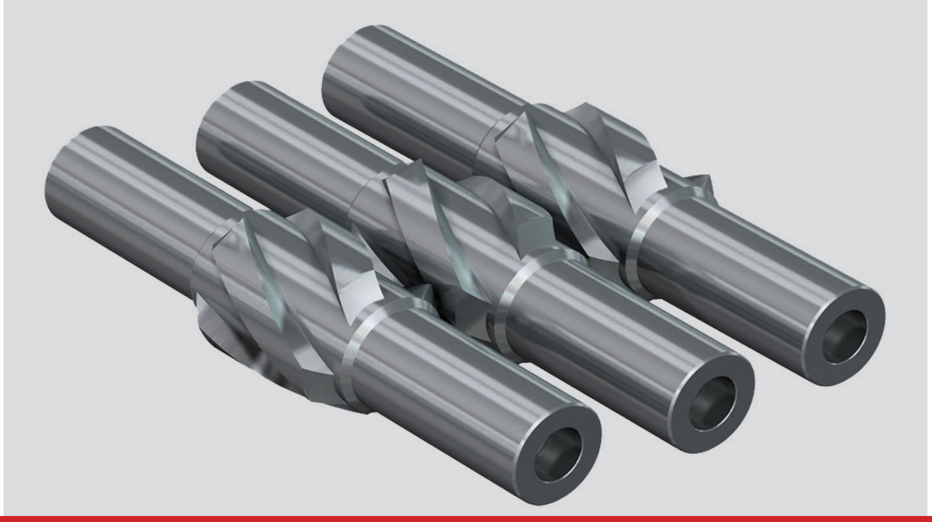

Drill stabilizers are subject to extreme slurry abrasion. Carbide materials help to increase drilling uptime.

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