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In the War Against Maritime Corrosion, Clean Lasers Prove Very Effective

By Del Williams

Clean technology lasers offer superior industrial corrosion removal in myriad applications and can help solve some of the industry's most costly corrosion problems.

The global maritime industry, including shipbuilding as well as ship maintenance and repair, has been fighting a war against corrosion in metal vessels, infrastructure and equipment at great expense for generations.

"The global cost of corrosion is estimated to be $2.5 trillion, which is equivalent to about 2% of the global gross domestic product, according to a National Association of Corrosion Engineers International study to examine the role of corrosion management in industry and government and to establish best practices.

Given the maritime industry's need to keep metal vessels seaworthy as well as all infrastructure and equipment shipshape, proactively controlling corrosion is imperative and can have an equally impressive return on investment.

"By using available corrosion control practices, it is estimated that savings of between 15 and 35% of the cost of corrosion could be realized, i.e., between $375 and $875 billion annually on a global basis … the fact that corrosion control provides a cost benefit is a lesson learned over and over again by industry, often too late and following catastrophic events," the NACE International IMPACT study states.

However, traditional methods of removing corrosion can be messy, laborious, time consuming, and even can pose serious health hazards.

Today, one of the easiest and most effective alternatives in the war against corrosion is the increasingly important category of industrial-grade, clean technology lasers. With this approach, precision laser-based systems are used to remove corrosion, contaminants, paint and residues with a high-energy laser beam that leaves the substrate unaffected.

The technology is extremely effective in fighting corrosion, and not only facilitates pre-surface coating preparation but also pre-weld treatment and post-weld cleaning in the repair of ships and maritime equipment.

Preparation and cleanup time are minimal, and the low-maintenance equipment can last decades. The technology minimizes operator exposure to potential environmental health hazards. In addition, no consumables are necessary.

Corrosion and the Limits of Conventional Control

Any industry with metal infrastructure, processing equipment, or products exposed to water, fluids, moisture or atmospheric humidity continually fights corrosion, which causes the deterioration and loss of a material and its critical properties due to chemical and electrochemical reactions of the exposed surface with the surrounding environment.

Corrosion affects the microstructure, mechanical properties and physical appearance of the materials.

The direct cost of corrosion includes a loss of materials, equipment and production, plus the cost of repair, maintenance and replacement. Additional losses can result from accidents, injuries and even loss of life as well as payments to repair environmental damage.

"With laser-based systems, an operator simply points and clicks a high-energy laser beam at the surface."

Wayne Tupuola, CEO Laser Photonics

Within the continual struggle against maritime corrosion, one important niche area of corrosion control involves the pre-treating of metal surfaces to remove corrosion and contaminants before coating or welding.

Although metal surface pre-treatment is a small portion of industrial corrosion control, it is crucial to ensure the safety, performance and longevity of metal vessels, infrastructure and equipment.

Insufficient coating pre-treatment can lead to inadequate protection from the environment, leading to potential coating failure, moisture entry and accelerated corrosion, as well as increased maintenance, early replacement and warranty issues. Similarly, insufficient weld pre-treatment to remove corrosion and contaminants can lead to weakened or failed welds and necessary re-work, as well as substantial safety, liability and litigation risk.

A More Effective Weapon to Eliminate Corrosion

In the maritime industry, it is necessary to remove corrosion, residue, oil, grease or paint before coating a vessel, equipment or infrastructure to improve coating adhesion.

Toward this end, laser-based systems have significant advantages over traditional methods, starting with ease of use.

"With laser-based systems, an operator simply points and clicks a high-energy laser beam at the surface," Wayne Tupuola, CEO of Laser Photonics, a Florida-based provider of patented industrial grade CleanTech lasers for cleaning and surface conditioning, said.

"The substrate is not affected by the laser, and the systems don't create any mess or byproducts," he continued. "The approach is eco-friendly, energy-efficient and completes the job in about half the time of traditional methods when preparation and cleanup are considered. Also, no consumables are required."

The company's systems function either as mobile standalone units or can be integrated into production lines.

In the case of Laser Photonics, the laser systems are available in portable and stationary models ranging from 50 to 3,000-watts (a 4,000-watt version is in development) with chamber sizes from three-by-three feet in size to six-by-12 feet. The systems also can be installed in manufacturing lines in cabinets or operated by a robotic arm.

Given its effectiveness treating metal surfaces, industrial laser systems are increasingly being used at shipyards, shipbuilding berths and even aboard ships. Technicians can use mobile handheld units, or if needed the systems can be integrated into automated inline processing lines.

In the shipbuilding industry, operators are utilizing industrial grade laser systems to maintain a wide range of vital interior and exterior equipment. Operators are using CleanTech systems to smooth surfaces and remove rust and scale from engines, generators, fuel pumps, water separators, winches, anchoring chains, and gear shifting and throttle components without disassembly.

This improves safety, function and lifespan, while reducing the risk of premature failure, which could be very dangerous during an emergency such as a storm on the high seas.

The laser systems similarly maintain door hinges and locks as well as remove saltwater stains from metal surfaces. In addition, the technology is used for selective de-painting and cleaning of access points, service latches and other maritime applications.

Another common laser application involves pre-weld treatment to remove corrosion, mill scale, residue and any impurities on the surface of the base material that would compromise a weld's effectiveness.

It is essential to avoid any such contamination on a weld's surface, which could otherwise lead to a weakening of the weld's mechanical properties, requiring re-work.

Laser treatment is also used for post-weld cleaning to increase the life expectancy and corrosion resistance of a welded joint. Post-weld cleaning is important for stainless steel as well. Welding can cause a "heat tint," a discolored, thickened top layer on the stainless steel around the weld bead within the heat-affected zone that compromises corrosion resistance.

Removing the heat-tinted top layer is necessary to restore stainless steel's full corrosion resistance.

A further benefit of laser systems is that some of the most advanced units are designed to last for decades. For example, CleanTech has said that it's laser systems can last 50,000 to 100,000 hours. In addition, virtually no maintenance is needed after purchase and no consumables are required, according to the company.

Given the devastating cost of corrosion to the maritime industry and the inherent limitations of typical control methods, lasers are becoming a best practice technique to combat it in shipyards and on the high seas.

Laser treatment effectively removes corrosion for many applications, minimizes cleanup time and operator exposure to potential environmental health hazards, and lasts for decades.

More information on laser cleaning solutions for surface preparation is available at www.laserphotonics.com. ■

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