

F149-14 Metallisation and LASE Collaboration on Laser Cladding

Metallisation Launches New Laser Cladding System

Metallisation has launched a new laser cladding system, MET-CLAD, which has further enhanced Metallisation's diverse range of surface coating equipment.

Laser cladding, a process that falls into the range of hard-facing solutions, can be used to increase corrosion resistance, wear resistance or impact performance of metallic components, using a method of applying a fully dense, metallurgically bonded and virtually pure coating.

The Metallisation MET-CLAD system has been developed as a result of a collaboration with laser cladding specialists, LASE Ltd, based in South Wales. Metallisation, experts in machine building, offers laser cladding systems and technical support to industry, supported by LASE Ltd.'s extensive laser cladding expertise and experience.

Metallisation has supplied its first MET-CLAD system to LASE, at its South Wales factory, where it has been successfully integrated into the production facility. The new system is also flexible enough to be taken on-site if the size of the customer's component prohibits transportation to the South Wales facility.



The laser cladding process utilises a precisely focused high power laser beam to create a tightly controlled weld pool into which a metallic powder is applied. The powder is carried by a stream of inert shielding gas, which is blown coaxially through the laser beam. The highly accurate nature of the laser beam allows fully dense cladding with minimal dilution and a perfect metallurgical bond. The number of coatings that can be applied are vast, the composition of which can be designed to combat failure mechanisms associated with each component.

The Laser cladding process produces a coating with a higher level of purity than other traditional welded hard facing processes. The coating properties, and the high level of purity, will maximise the working life of components and minimise downtime. The very low heat input, associated with a

laser, minimises distortion and results in a refined microstructure. Due to the high level of accuracy and control laser cladding enables the cost effective application of high performance alloys to tackle a wide range of engineering issues.

The MET-CLAD laser cladding control console, developed and built by Metallisation, is at the heart of the system, as it provides integration and control of the complex component parts. To apply a laser clad coating the cladding head has to be fed with four key things; a laser beam, process gasses, powder and cooling water. This is where the MET-CLAD system steps in with a very simple to use control system and touch screen HMI. The MET-CLAD control system is based on the tried and tested Metallisation HVOF and Plasma control concept. The control interface for production operations is simple, but it can be drilled down to a great level of complexity for coating development. Repeatable operations are easily programmed or they can be linked to a barcode system for even simpler programming. The process gases are mass flow controlled for repeatability of the coating process.

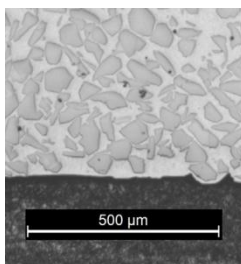


One of the major benefits of laser cladding is the ability to finely control the heat input to the substrate and the coating material, which allows a deposit of a two phase Metal Matrix Composite Structure. This means the coating can have a softer, lower melting point material (the matrix) where a harder wearing, higher melting point material (the hard phase) is suspended.

The matrix material is typically a nickel based alloy, which provides a tough, ductile and impact resistant surface, while being wear resistant at elevated temperatures. The reinforcing hard phase is typically tungsten carbide, but can also be titanium carbide or chromium carbide. The fine control of the heat input allows the matrix to be completely melted, alloyed and bonded to the substrate surface. The carbide particles remain un-melted and are distributed evenly through the matrix, resulting in an extremely strong wear and impact resistant coating.

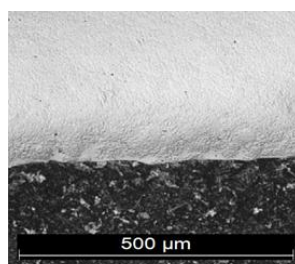
Typical examples of very dense, fully bonded laser clad coatings

Coarse WC in a Ni Matrix



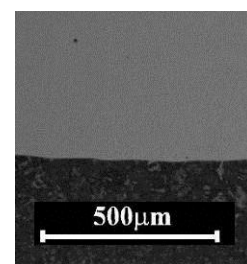
Hardness: Matrix: 500–600 Hv
Carbide 2000–2500 Hv

FeCrB



Hardness: 900 - 1100 Hv

NiCrMo (similar to Inconel625)



Hardness: 300 Hv

Comparison of coating processes

The following table gives a broad comparison of coating processes. The data shown is based on typical applications and parameters. There can be exceptions to this data, dependent on the specific applications and parameters, Metallisation will be happy to offer advice for specific applications.

| | HVOF Thermal Spray | PTA | Laser Cladding |
|------------------------------------|---------------------------|---------------|-----------------------|
| Heat Source | Flame (liquid or gas) | Electric arc | Laser beam |
| Coating thickness (typical) | 0.05 – 1mm | 0.5 – 5mm | 0.2 – 2mm |
| Typical Deposition rates | ≤ 5 kg/hr | ≤ 10 kg/hour | ≤ 5kg/hr |
| Dilution | 0 | 5-15% | ≤ 5% |
| Type of bonding | Mechanical | Metallurgical | Metallurgical |
| Bond strength | ≤ 80 MPa | ≤ 800 MPa | ≤ 800 MPa |
| Heat input | Low – medium | High | Low - medium |
| Porosity | ≤ 1% | < 0.1% | < 0.1% |
| Comparative capital cost | Medium | Low | High |
| Comparative running cost | High | Medium - Low | Low |

The oil and gas industry commonly use laser cladding for many of its processes including oil refinery process plants, valve balls/seats, down hole stabilisers, sand valves and hydraulic rods. The steel industry would typically use laser cladding in process rolls, high temperature process rolls, coal and ore crushing hammers and wear plates. Various other industry sectors, such as automotive and power generation, will also have applications for laser cladding. The coating materials are just as diverse as the applications and include, Cobalt 6, WC/Ni, NiCrMo and FeCrB

LASE Ltd was established by Sam Lester, who has extensive experience in laser cladding, and his brother Ben, who is a qualified CNC Programmer. Sam, Technical Director at LASE says: “The MET-CLAD system is the result of a lot of work between us and Metallisation. I am delighted with the system, which is very easy to use and incredibly flexible. Traditionally, laser systems have been cumbersome and technically complex, which limited the uptake of laser cladding in industry. Now, thanks to the input of both LASE and Metallisation, we have a system that is robust, simple to use, incredibly effective.”

For more information on the MET-CLAD Laser Cladding System, please contact Stuart Milton, Sales Director, Metallisation, on +44 (0)1384 252 464 or visit www.metallisation.com