

Laser Cladding for Critical Component Repair – Duplex Stainless Steel

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Introduction

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.

Laser cladding can be used across a diverse range of industries. In this instance it was used to repair an EN8 steel drive shaft from a large CNC boring machine. The steel drive shaft had become worn in two bearing areas and was considered 'unweldable' by standard methods. Due to the critical dimensions of the shaft, and its relatively small size, it was crucial that distortion had to be controlled.

The Laser cladding process was an ideal solution for the EN8 steel drive shaft, as it produces a coating with a higher level of purity than other traditional welded hard facing processes. Also, the very low heat input, associated with a laser, minimises distortion and results in a refined microstructure.

Materials

Main Deposit

Duplex stainless steel.

Method

Preparation

Clean the worn bearing areas with alcohol to remove grease.

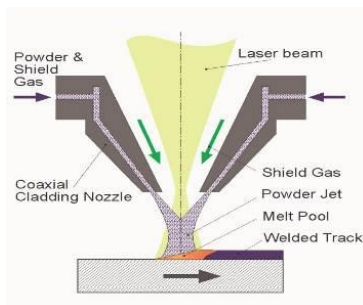
Equipment

Metallisation MET-CLAD system

Application of Laser Cladding

The two worn surface areas of the EN8 steel drive shaft were laser clad with duplex stainless steel and machined back to their original dimensions, enabling the shaft to be returned to the CNC boring machine.

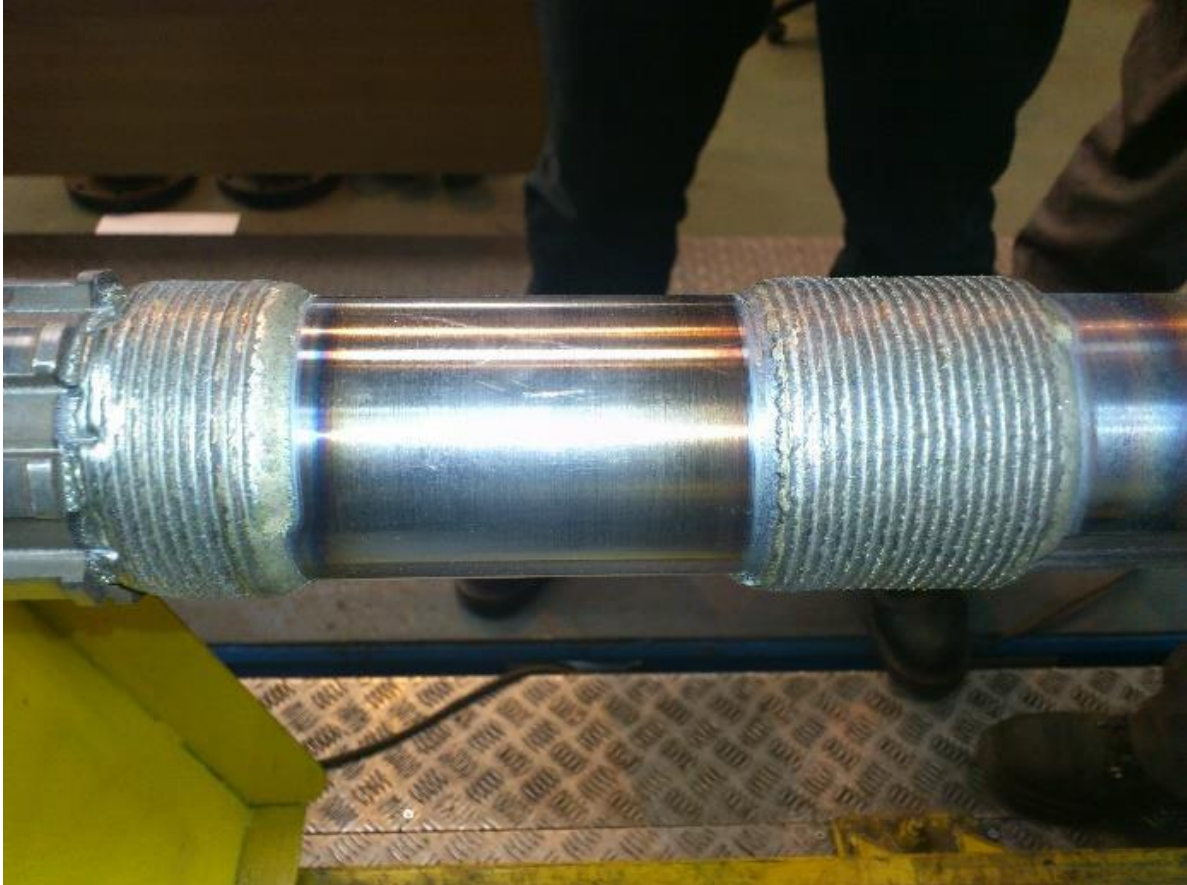
The laser cladding process utilises a precisely focused high power laser beam to create a tightly controlled weld pool into which a metallic powder is applied. The powder is carried by a stream of inert shielding gas, which is blown coaxially through the laser beam. The highly controllable nature of the laser beam allows fully dense cladding with minimal dilution and a perfect metallurgical bond.



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. Typical deposition rates are between 60 and 100 g/min around 3-6 kilograms per hour, depending on the material being deposited and the geometry of the work piece.

To apply a laser clad coating the cladding head has to be fed with four key things; a laser beam, process gasses, the metallic powder and cooling water. The Metallisation MET-CLAD laser cladding control console provides integration and control of the complex component parts. The MET-CLAD system is a simple to use control system with touch screen HMI and is based on the Metallisation HVOF and Plasma control concept.

Using laser cladding to repair the EN8 steel drive shaft was the ideal solution, as the repair had to be of a high strength due to the load bearing pressure placed on the working component. The chemistry of the shaft was unsuitable for a traditional welding process due to its high carbon content and it was crucial there was absolutely no distortion. Finally, the low heat input associated with a laser clad coating, had a minimal effect on the base material strength.



The shaft with the clad coating

Conclusion

Laser cladding is capable of producing coatings with a combination of excellent toughness and abrasive wear resistance and is ideal for Critical Component Repair work.

In this instance, due to the low heat input in the laser cladding process, the duplex stainless steel and the EN8 steel drive shaft remained intact, without distortion. A critical requirement in this type of project.