

APPLICATION NOTE

Wear Protection for Heavy Industry

Introduction

Multi-kilowatt diode lasers are ideal for cladding applications in heavy industry (transportation, oil & gas, and construction). Cladding can increase the wear resistance and extend the operating lifetime of metal parts which are subjected to high mechanical stress. Cladding can also enhance corrosion and chemical resistance, and be used for repair of worn or damaged parts.

Cladding delivers a part with the best characteristics of both the matrix and cladding materials. For example, cladding a carbide alloy on a steel part provides a surface layer with a hardness of up to 3000 HV, meaning superior wear resistance. But, the bulk part still retains the excellent mechanical strength and the flexibility of the steel.

Process

Cladding involves melting the new material, usually in powder form, and a thin layer of the substrate. This creates a true metallurgical bond between clad and matrix, so that it won't separate off in use. To be economically viable, cladding must be fast and energy efficient. For the large parts used in heavy industry this usually means rapidly covering large areas. Laser cladding systems having a small, round, focused laser spot can't deliver this speed. Instead, a high power (multi-kW) laser beam formed into a long line (as much as 24 mm) is best.

Coherent HighLight DL and HighLight DD series diode lasers deliver the power and beam characteristics required for cladding. The Coherent gravity powder nozzle can be used with these for cladding flat and large cylindrical parts with a powder efficiency of about 98%. There's also a Coherent coaxial nozzle for high speed cladding of 3D shaped parts.

Results

This process reaches deposition rates of up to 10 kg/h. And, the highly selective heating avoids overheating the cladding material or distorting the part itself, which might necessitate costly post processing. The rapid cooling rate allows the melt pool to solidify before there's too much mixing of clad and matrix, yielding a superior microstructure.

Application Field

High Power Diode Laser Cladding.



Figure 1: Wear Protection in Heavy Industry

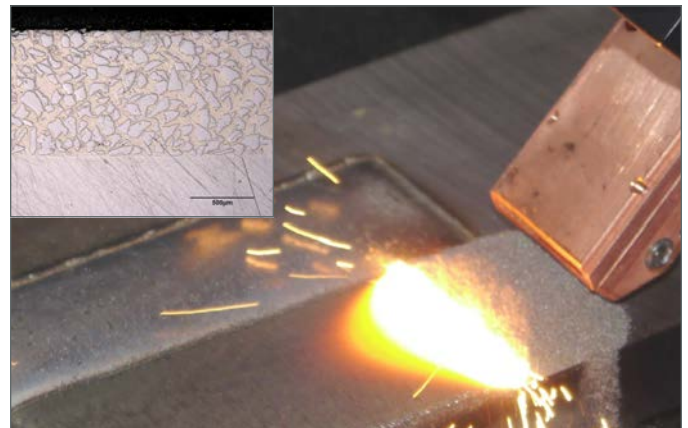


Figure 2: Cladding with Gravity Nozzle

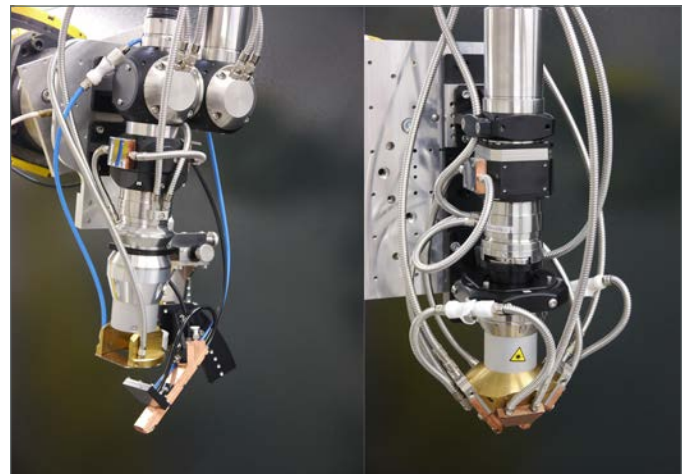


Figure 3: Left: Processing head with gravity powder feeding; Right: Processing head with coaxial pressurized powder feeding

Contact

Coherent Applications Lab: Hamburg, Germany
Email: applslab@coherent.com