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Laser Welding

Laser welding involves joining components by utilising a laser source, which may or may not require additional filler material. This technique is applied in various areas, such as welding automotive body panels, creating lightweight structures, manufacturing stainless steel tubing, and fixing gears to shafts, among others.

Benefits of Laser Welding

- Minimal distortion
- Low heat input
- Small heat-affected zones
- Deep-penetration welding
- High welding speeds and high assurance
- Dissimilar material welding
- Simplified welding preparation
- Autogenous welding.

The CSIR capability in laser surface engineering comprises a series of research and development programmes that form the basis of the organisation's specialised consultation services. Aside from contract-based manufacturing support, the CSIR focuses on the industrialisation of laser-based technologies and their implementation in the economy as part of technology localisation and in line with South Africa's reindustrialisation efforts.

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EFFICIENCY AND COST-SAVING ACROSS INDUSTRIES

LASER-BASED SURFACE ENGINEERING

The Council for Scientific and Industrial Research (CSIR) has a diverse and specialised portfolio of laser-based technologies to support various industries such as manufacturing, mining, defence, transport, energy, etc. By designing novel technologies and enhanced processing approaches, these services typically reduce costs, saving time by limiting downtime, reducing wastage, and improving performance.

Laser Cladding

This is a process of laser refurbishment used to restore worn, damaged, or faulty components. Applications of laser cladding involve repairing various items, such as moulds, shafts, compressor screws, turbine blades, continuous casting rolls, and sealing cracks, among others.

Benefits of Laser Cladding

- Repairing of worn components to original specifications
- Thin layers with low dilution, thus saving on consumables and machining
- Metallurgical damage due to extended heat-affected zones is vastly reduced
- Vastly reduced thermal distortion due to low heat input.

Mobile Laser-based Refurbishment System

The CSIR developed a strong competence in laser-based refurbishment, based on laser cladding technology. The system was designed for on-site welding. This capability is invaluable for the refurbishment of large and high-value components with faster response times and significant cost savings to industry.

Benefits of the Mobile Laser-based Refurbishment System

- On-site high-volume components repair
- Reduces time
- Creates layers as thin as 0.5 mm due to the very low dilution
- Can repair selected areas on high-value components.

3D Laser Cutting and 3D Pipe Cutting

The 5-axis, 5kW CO2 laser system is designed for cutting three-dimensional parts and tubes. Its applications encompass a variety of tasks including the laser cutting of welding preparations on tubes, the precise cutting of square tubes, the shaping of formed body parts, and the fabrication of automotive body components.

Benefits of 3D Laser Cutting and 3D Pipe Cutting

- High accuracy
- High-edge quality
- No post-processing
- Intricate detail, small holes
- Faster product delivery
- Profiling of formed component
- Ideal for rim and product development
- Cost-effective solution for manufacturing of low-volume components.

Laser Hardening

Laser transformation hardening is used on carbon steels that contain between 0.3% and 1.5% carbon, including cast iron. This technique finds applications in various areas such as repairing gears, press tools, components in automotive steering pumps, forming tools and moulds, piston ring grooves in heavy-duty engines, and turbine blades, among others.

Benefits of Laser Hardening

- Selective area hardening without affecting surrounding material
- Quick turnaround time
- Treatment depth accurately controlled and highly reproducible due to direct temperature control
- Superior hardness can be obtained compared to conventional processes (typically 20% higher hardness)
- No external quenching is required and thus eliminates complex quenching equipment
- Minimal heat input
- Limited distortion
- No need for post-treatment machining
- Final machined components for laser hardening
- Environmentally friendly.