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Supersonic Low-Pressure Cold Spray System

Chengdu Greenstone Laser Technology Co., Ltd

www.greenstone-tech.com

GST-SLPCS-150 II/III Supersonic Low-Pressure Cold Spray Equipment

II

III

Technical Principle

Supersonic Cold Spray, also known as Low-Pressure Cold Spray (LPCS), is an advanced metal coating technology.

Unlike traditional thermal spray methods (such as High-Velocity Oxy-Fuel (HVOF) spraying, plasma spraying, or detonation spraying), this process does not require melting the metal particles. The temperature at the substrate surface typically does not exceed 150°C, ensuring minimal thermal impact on the base material.

The technical principle of supersonic cold spray involves using compressed gas accelerated through a converging-diverging Laval nozzle to generate a supersonic gas stream. Powder particles are introduced axially into this stream, forming a gas-solid two-phase flow. After being accelerated, the solid particles impact the substrate in a fully solid state, undergo significant plastic deformation, and deposit onto the surface, forming a dense and strong coating layer.

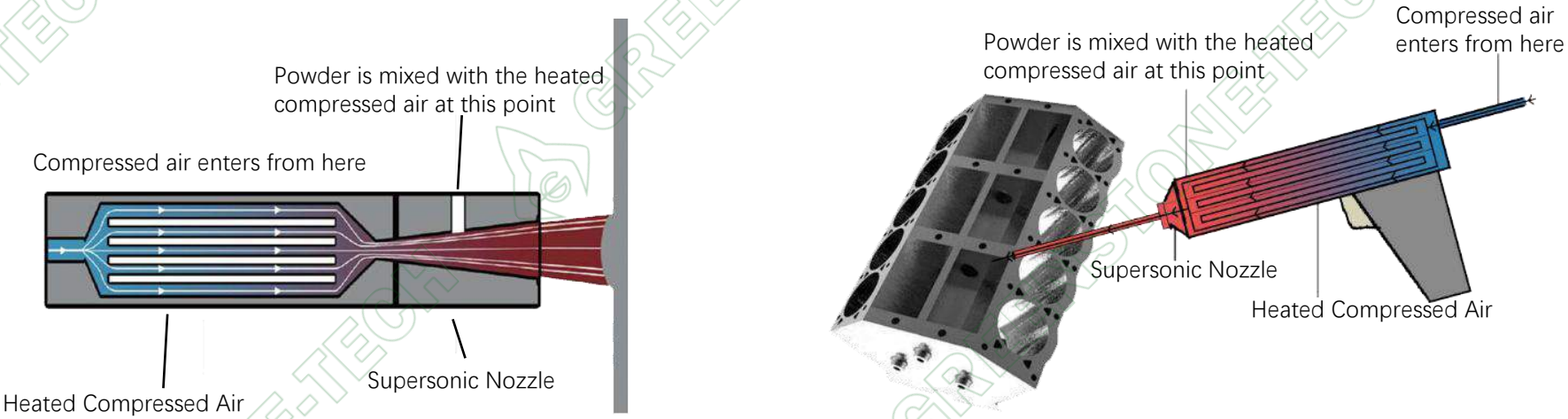


Figure 1 GST-SLPCS-150 II/III Schematic Diagram

Technical Characteristics of Our Supersonic Cold Spray Technology

1. The GST-SLPCS-150 II/III supersonic cold spray system features a compact and portable design. It has no special requirements for working conditions and can operate under normal temperature and humidity, suitable for both fixed installations and field applications.

2. The substrate temperature remains below 150°C during spraying, eliminating thermal stress, oxidation, phase transformation, or ablation. It can deposit coatings up to 10mm thick with excellent uniformity and surface finish (Rz20~40).

3. The coatings exhibit:High bond strength: 30~100MPa;Strong cohesion: 30~100MPa;Dense structure with low porosity (1~3%);High thermal/electrical conductivity (>92%).

4. A single cold spray system can process various powder materials (Al, Cu, Zn, Ni, Co, Sn, Babbitt alloys, etc.) to produce functional coatings. The process is cold, emitting no hazardous gases or radiation, making it environmentally friendly.

5. Except for heavy rust layers, no special surface cleaning is required - the system can self-clean industrial contaminants, paint, and fatigue layers from surfaces.

6. The particle jet features a small, narrow cross-section with excellent directionality, enabling precise localized spraying with clearly defined boundaries.

7. Applicable to all metal products as well as ceramic, glass, and concrete surfaces.

GST-SLPCS-150 II/III Technical Parameters

Technical Specifications	Parameter Values
Input Power Supply	220V ± 10% 50Hz
Maximum Power Consumption (kW)	3.3
Working Surface Temperature	< 150°C
Compressed Air Working Pressure (MPa)	0.5~0.8 (5~8 atm)
Compressed Air Working Temperature (°C)	200~600
Compressed Air Consumption (m^3/min)	0.3~0.5
Air Quality Requirements	Oil-free, Water-free, <40°C
Powder Feed Rate (g/min)	6~50
Suitable Powder Types	Aluminum, Copper, Zinc, Nickel, Tin, Babbitt Alloy
Spray Powder Particle Size (μm)	15~40
Spray Distance (mm)	5~15
Porosity	1%~3%
Bond Strength (MPa)	30~100

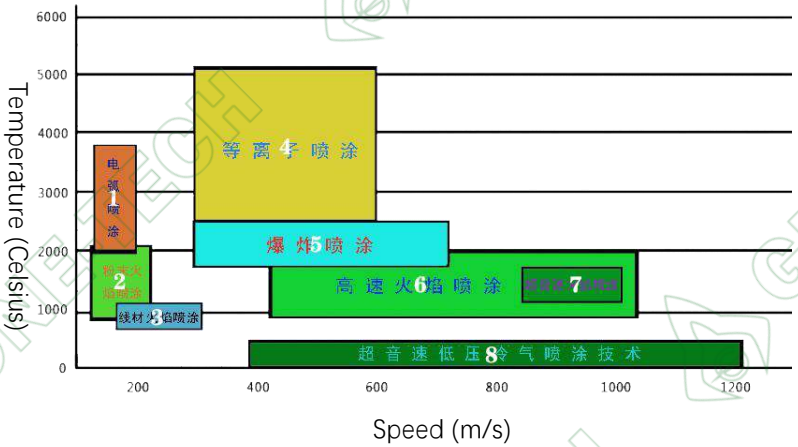


Fig. 2 Schematic diagram comparing the characteristics of supersonic cold spraying and conventional spraying technology

1.Arc Spraying
2.Powder flame spraying
3.Wire flame spraying
4.Plasma spraying
5.Explosion Spraying
6.High-speed flame spraying
7.Supersonic Flame Spraying
8. Supersonic low-pressure cold air spraying technology

Comparison of Process Characteristics of Supersonic Low-Pressure Cold Spraying With Other Thermal Spraying Methods

Performance Indicator	Supersonic Low-Pressure Cold Spray	Supersonic Spraying	Plasma Spraying	Arc Spraying	Detonation Spraying
Equipment Complexity	Simple	Simple	Complex	Simple	Complex
Required Gases	Compressed air	Compressed air + propane/oxygen	Large compressor + H_2 /N_2 /Ar	Medium/large compressor	Acetylene + oxygen
Power Requirement	220V lighting + 7.5KW compressor	7.5KW compressor	⩾20KW	⩾10KW	220V lighting only
Bond Strength (MPa)	30-100	40-80	20-50	10-40	40-120
Coating Porosity	1-2%	1-5%	2-8%	1-10%	1-3%
Heat Affected Zone	Small	Medium	Large	Large	Medium
Working Condition Requirements	Low	Low	High	Medium	High
Environmental Impact	Low	Medium	High	High	High
Operation Process	Simple	Simple	Complex	Moderate	Complex
Spray Efficiency	Medium	Medium	High	High	Medium
Spraying Cost	Low	Medium	High	Low	Medium
Pre-treatment	Built-in sandblasting	Separate sandblasting required			

GST-SLPCS-150 II/III System Components

Supersonic cold spraying mainly consists of spraying gun, double barrel powder feeder, program control system, spraying cabinet and alloy powder.

Fig. 3 Spray gun

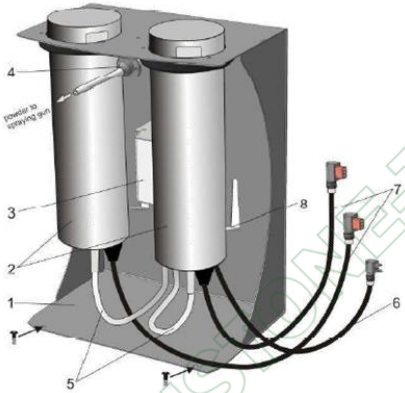


Fig. 4 Double barrel powder feeder

Fig. 5 Spray Cabinet

Fig. 6 Program control panel diagram

Fig. 7 Alloy Powder

GST-SLPCS-150 II/III System Components

a. Round nozzle

b. Flat nozzles

Fig. 8 GST-SLPCS-150 II/III Spray Nozzle Schematic

Fig. 9 Sandblasting and spraying nozzles

Fig. 10 Nozzle for Babbitt Alloys

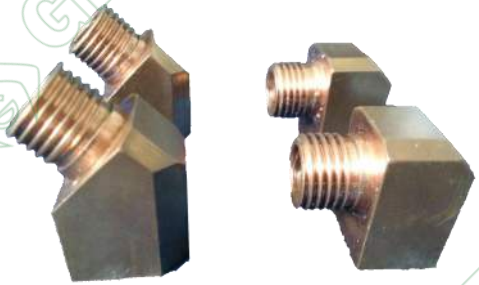
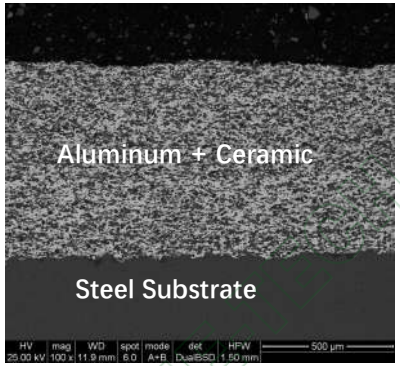


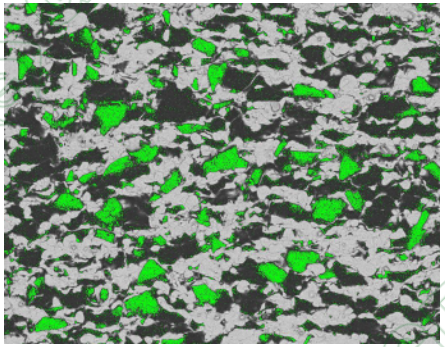
Fig. 11 Adapters

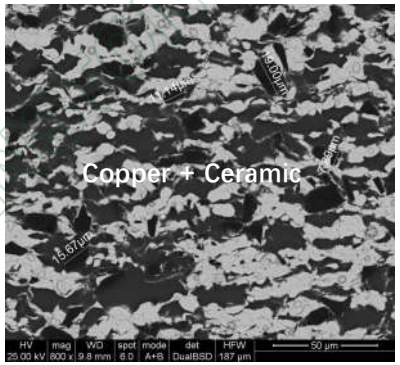
Spray Coating Types

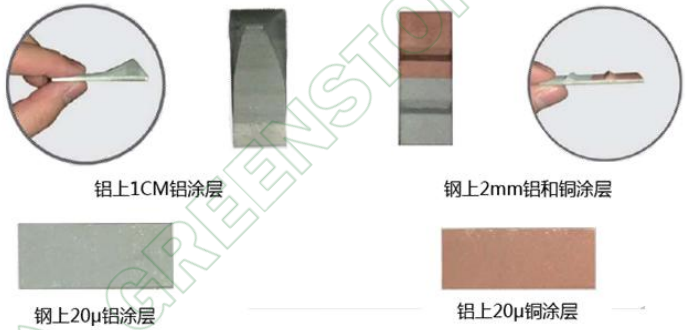
Numerous stable coating processes have been developed, primarily using powders of aluminum, copper, zinc, nickel, lead, tin, and Babbitt alloys. The achievable coating types include:

- Anti-corrosion Coatings
- Sealing Coatings (for liquid or gas flow containment)
- Dimensional Restoration Coatings (especially prominent in aluminum spraying/repair)
- Conductive Coatings
- Anti-wear Coatings (for rolling bearing restoration)
- Anti-galling Coatings for Threaded Connections (prevents adhesive tearing)
- Spark-safe Coatings
- Specialized Coatings (e.g., for aerospace industry applications)







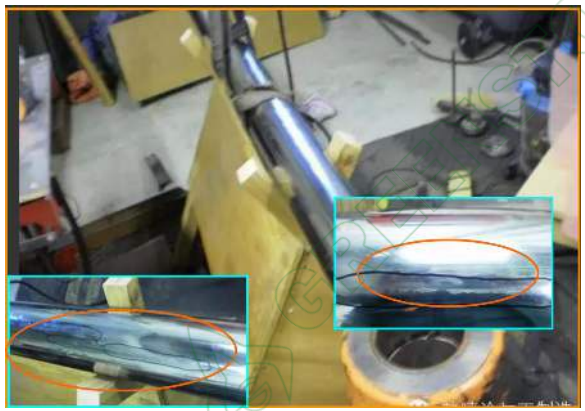


Application Areas

Cold spray technology applications categorized by coating functions:

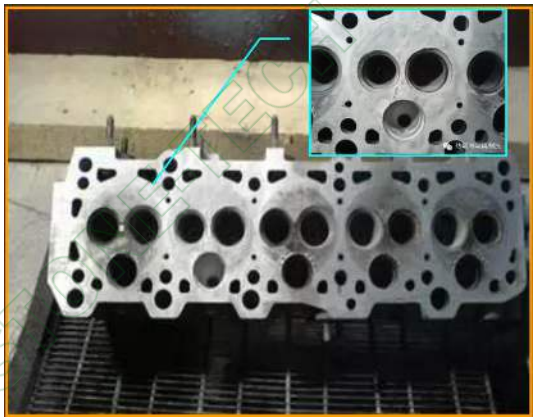
1.Corrosion-resistant Coatings
Anodic protection layers (Zn, Al, and alloys) on steel substrates
Cathodic metal coatings (e.g., Ni and alloys)
2.Wear-resistant & Friction-reducing Coatings
Metal-ceramic and anti-friction alloy coatings for machinery manufacturing and maintenance
3.Functional Coatings
Amorphous coatings, biomaterial coatings, and nanostructured coatings for scientific research and electronics
4.Spray-formed Components
Direct fabrication of shaped parts using Al, Cu, Ni, and alloys in mechanical and electronics industries
5.Component Repair
Automotive: Repairing engine blocks and sealing valves with Al, Cu, Ni, and alloys
Aerospace: Al and alloy coatings for rocket thruster restoration
6.Surface Treatment
Sandblasting to remove contaminants
Substrate preheating to reduce thermal stress

Application Examples



Roll damage repair

Shield center ring restoration size repair



Automotive Engine Wear Damage Repair

Application Examples

Cold Spray Repair of Parts

Application Examples

Motor Bearing Housing Wear -
After Cold Spray Repair

After Grinding

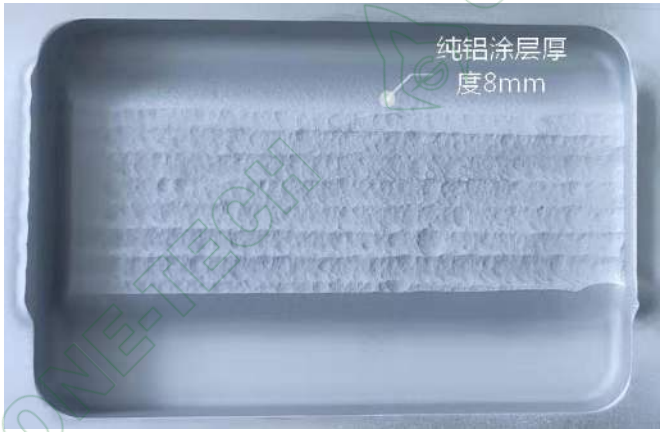
Application Examples

Bearing air seat wear - after repair by cold spraying

Application Examples

Supersonic Cold Spray - Pure Copper Coating on Aluminum

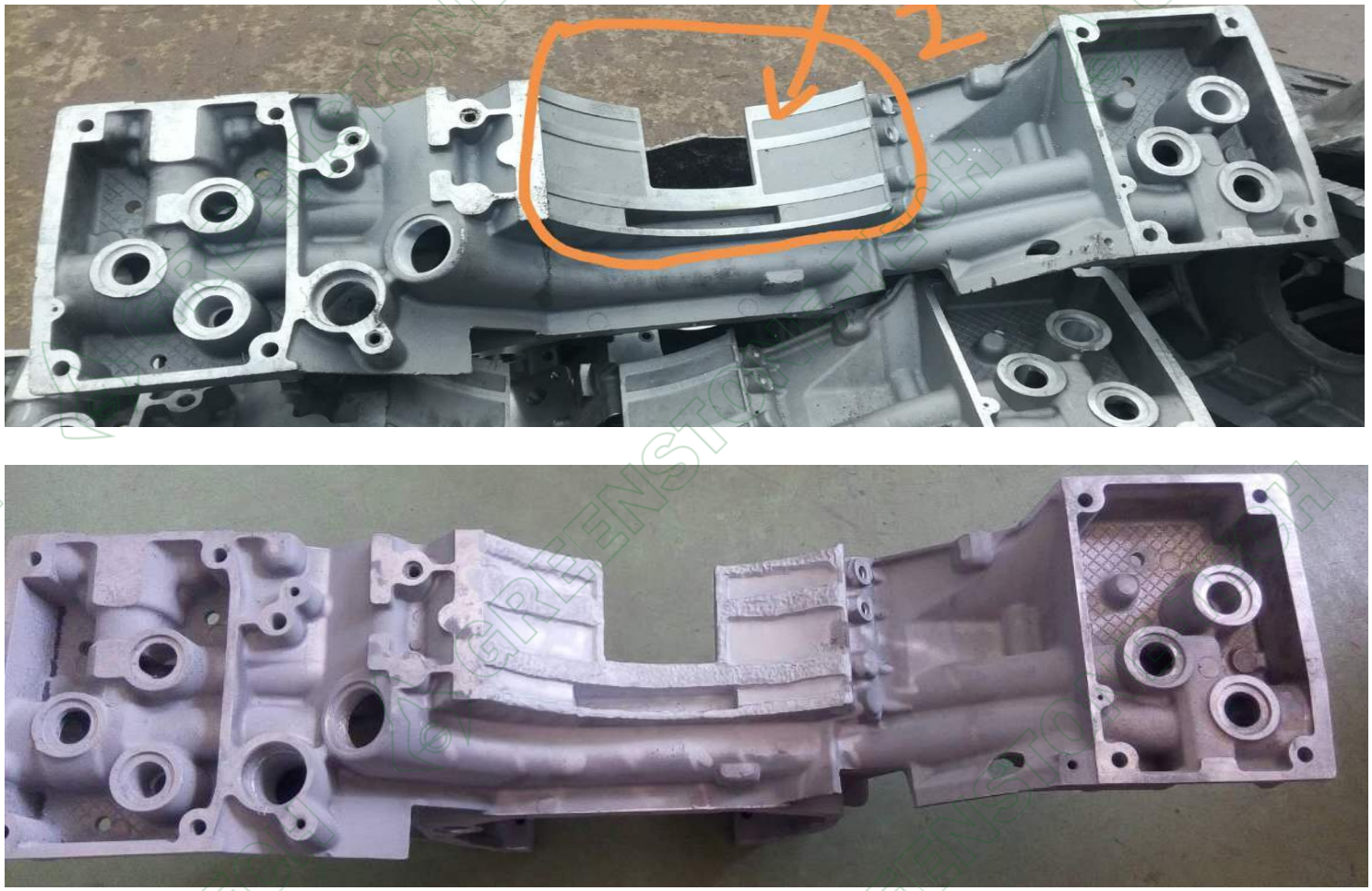
Application Examples



Fabrication of 8mm Pure Aluminum Coatings via Cold Spraying

Deposition of Babbitt Alloy Coatings on Substrate Surfaces via Cold Spraying

Application Examples



Repair of Aluminum Components by Cold Spraying

Application Examples

Cold Spray Repair of Aluminum Components

Application Examples

Cold Spray Repair of Aluminum Components

Application Examples

Automated Robotic Operation for Cold Spray Systems

Application Examples

Automated Robotic Operation for Cold Spray Systems

Application Examples

Cold Spray Application of Aluminum Coatings for Aerospace Parts

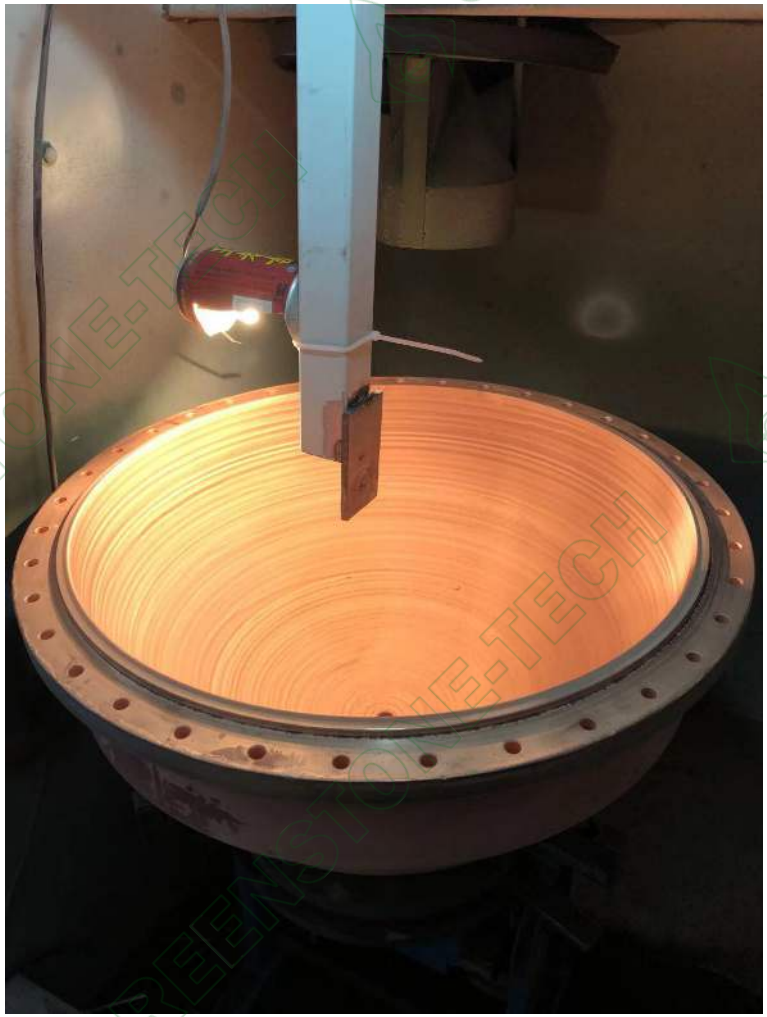
Application Examples

Cold Spray Application of Aluminum Coatings for Aerospace Parts

Application Examples

Cold Spray Copper Deposition on Heat Exchanger Surfaces

Application Examples

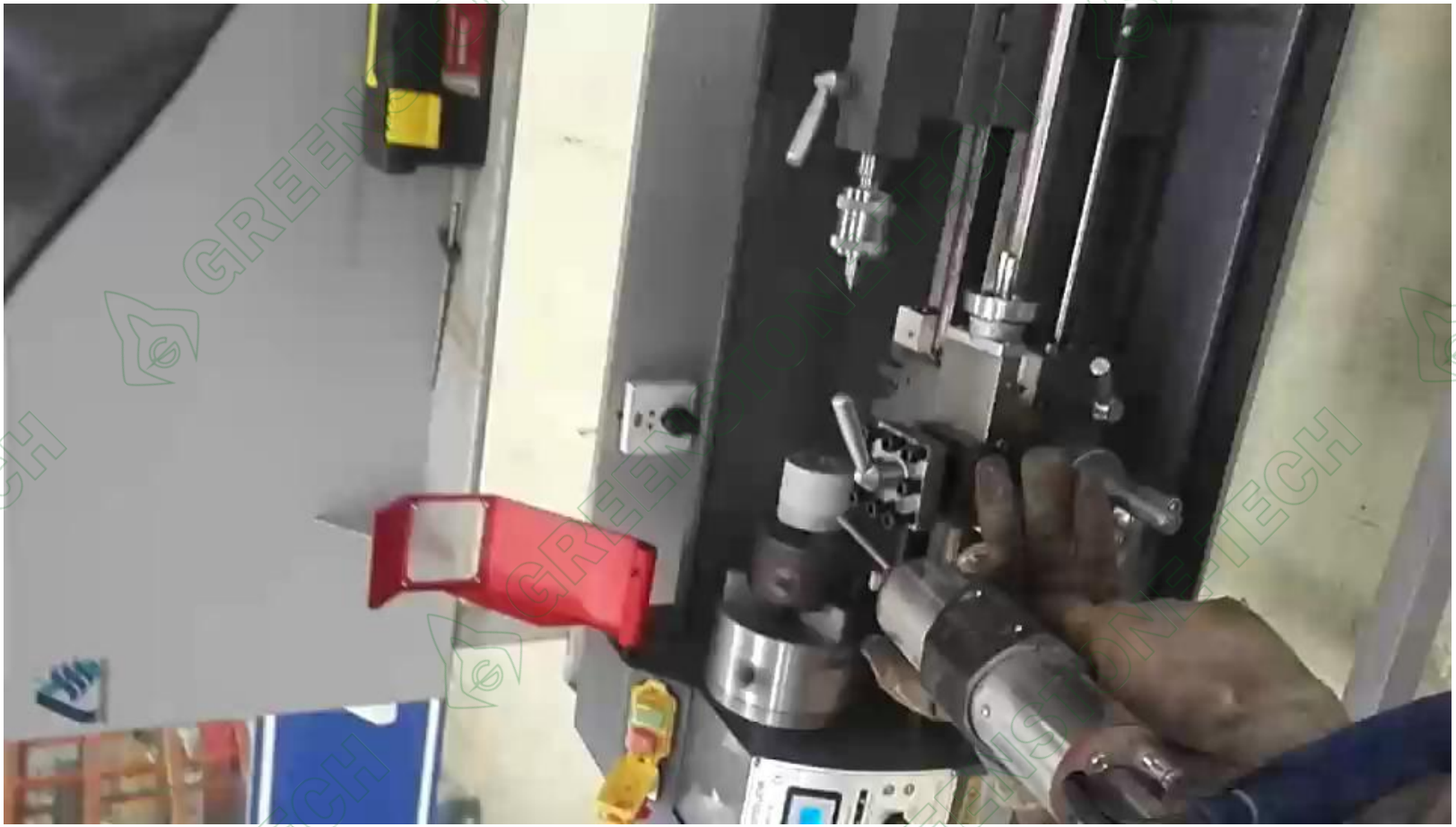


Cold Spray Deposition of Pure Copper Coatings on Aerospace Components

Application Examples

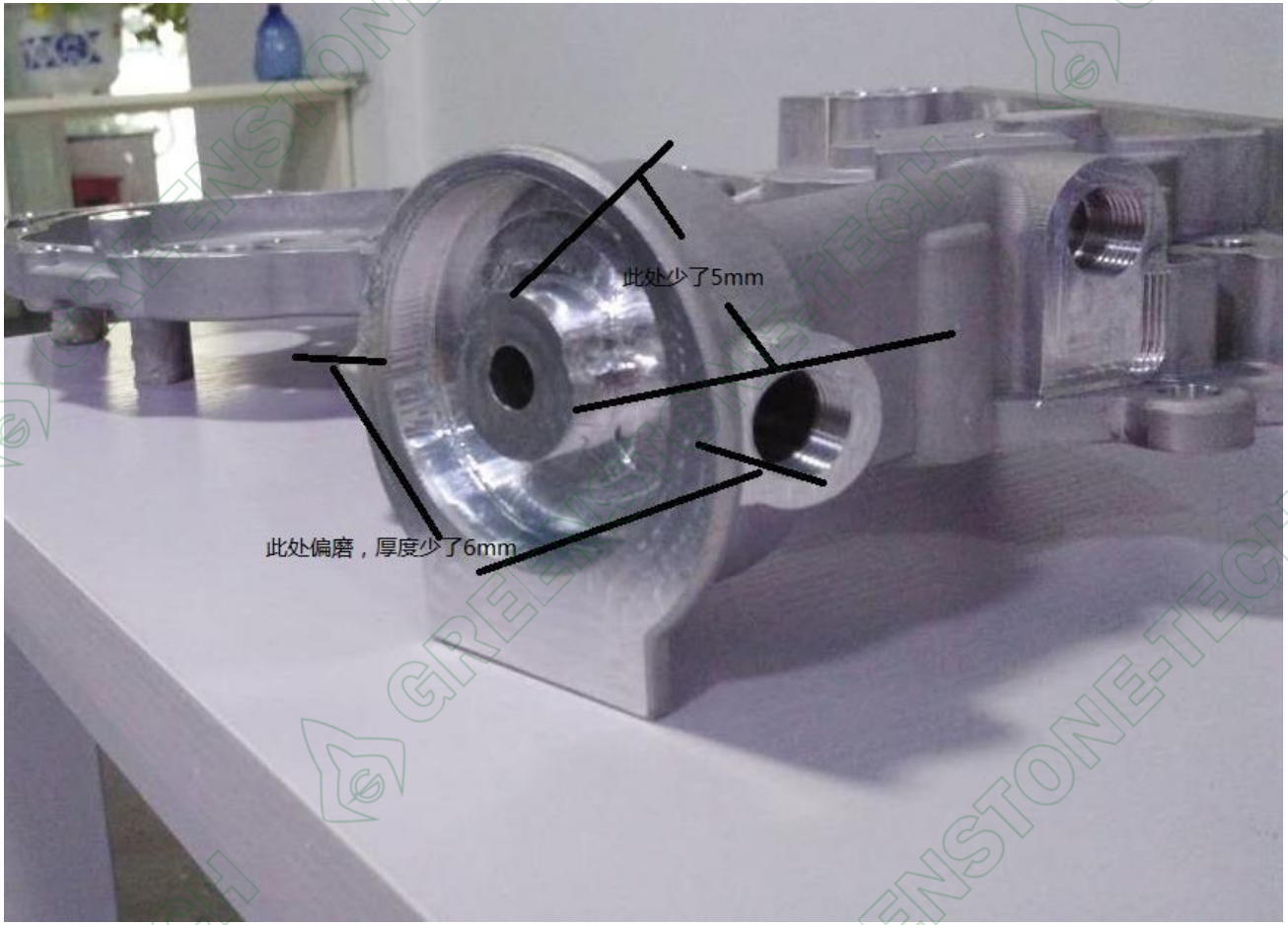
Cold Spray Deposition of Pure Copper Coatings on Aerospace Components

Application Examples



Cold Spray Deposition of Nickel Coatings

Application Examples



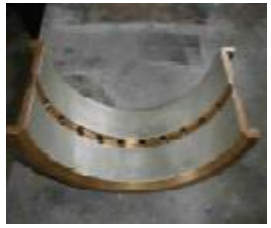
Cold Spray Repair of Aluminum Molds

Application Examples

Cold Spray Repair of Aluminum Molds

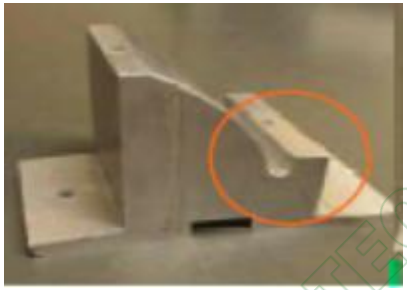
Application Examples

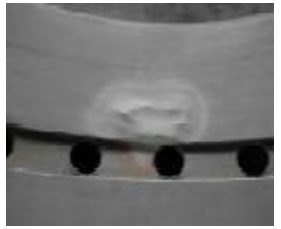










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Thank You!

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