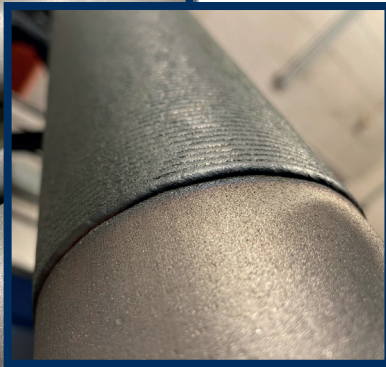




HÄUSER & CO

THERMAL SPRAYING PROCESSES FOR
METALLIC AND CERAMIC MATERIALS

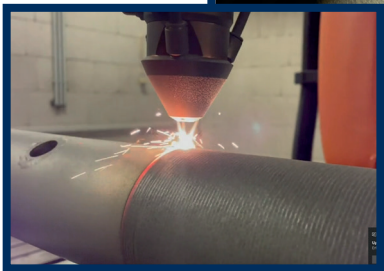


Laser Cladding

Plasma Spraying

Arc Spraying

HVOF Spraying



The Challenge

Power plants in general — and waste-to-energy plants in particular — are facing ever more extreme loads caused by variable and inhomogeneous fuels. This results in increasingly demanding operating conditions, driven by higher boiler temperatures, extreme chlorine loads and other aggressive constituents in the flue gas.

In practice, this translates into accelerated chlorine-induced high-temperature corrosion.

Chlorine, sulphur and heavy metal concentrations in the flue gas chemically attack the tube surface. Combined with dust loading, this leads to significant material loss on the base metal.

Left unprotected, boiler components often become unusable after only a short period of operation.

Repairs to membrane walls or superheater tubes caused by wall thinning — or, in the worst case, unplanned shutdowns due to leaks — result in high maintenance costs and reduced plant availability.

It follows that this is simply not economical.

Many plant operators therefore rely on corrosion-protection coatings. The investment pays off once service life is doubled — and considerably more is achievable: depending on the coating material and the physico-chemical loading involved, service life can be extended three- to four-fold compared with uncoated tubes.

+ Laser coatings applied using the Häuser process are particularly well suited to the demanding environment of fluidised-bed boilers.





Our coatings effectively protect membrane walls against:

- Chlorine-induced high-temperature corrosion
- Scaling
- Abrasion

Coating Material Radar

Below is a quick overview of the coating materials we most frequently apply, categorised by mode of action, coating process and typical field of application.

Coating Material Properties	HS 1.1	HS 4	HS 5	HS 6
Base metal	Nickel	Nickel	Nickel	Cobalt
Coating hardness ¹	35-43 HRC	55-61 HRC	170-200 HV1	55-60 HRC
Heat-treated	no	no	no	no
Thermal-shock resistant	no	no	no	no
Bonding mechanism	Mechanical			
Coating process				
Process	Plasma	Plasma/ Laser	Plasma	Plasma
Application	On-site / workshop			
Repairable by Häuser & Co ²	yes	yes	yes	no
Field of application				
Corrosion type	Chlorine			Sulphur
Mechanical issues	Abrasion			
Service temperature ³	600°C	700°C	600°C	900°C
Components / typical applications	Evaporators	Evaporators	Various components and pipework	Fluidised-bed coolers, ash chambers, evaporators, superheater tubes in the ash bed
Industry				
	Power plants	Power plants	Chemical and petrochemical industry	Coal-fired power plants

¹ Depending on the spraying process and parameters used.

² Depending on accessibility within the boiler.

³ Surface temperature; dependent on the specific application.

HS 52 / HS 4	HS 52	HS 53 VP	HS 3D	HS 100 D	IN 625	IN 686	Stelli-te™ 21
Nickel	Nickel	Nickel	Nickel	Eisen	Nickel	Nickel	Cobalt
53-57 HRC	49-54 HRC	59-64 HRC	35-43 HRC	> 67 HRC	18-25 HRC	18-25 HRC	30-34 HRC 54-56 HRC
yes	yes	yes	no	no	n/a	n/a	n/a
yes	yes	yes	no	no	yes	yes	yes
Diffusion-bonded / metallurgical			Mechanical				
Plasma	Plasma	Plasma	Arc spraying	Arc spraying	Laser	Laser	Laser
		Workshop	On-site / workshop		Workshop		
Limited			yes	Limited	yes	yes	yes
Chlorine					Chlorine		Sulphur
Erosion/ abrasion	Abrasion			Frictional wear			
700°C	600°C	700°C	700°C	900°C	< 420°C	< 550°C	600°C
Evaporators, superheaters	Evaporators, superheaters	Evaporators, superheaters	Evaporators, heating surfa- ces and screw conveyors	Pipework, shaft walls, screw convey- ors, chutes	Evaporators, superheaters	Evaporators, superheaters	Evaporators, superheaters
Überhitzer						Überhitzer	
Power plants	Power plants	Power plants and cement industry	Power plants and chemical industry	Power plants and cement industry	Power plants, chemical and maritime engineering	Power plants and chemical industry	Power plants and chemical industry

Process Radar

To help you better evaluate the thermal spraying processes employed by Häuser & Co, the table below provides a direct comparison.

	Arc Spraying / Plasma Spraying (without heat treatment)	Plasma Spraying (with heat treatment)	LaserCladding
Bond to tube surface	Mechanical interlock between base material and coating	Metallurgical bond; diffusion bond at atomic level	Fusion bond between base material and coating
Minimum wall thickness	Coating possible on tubes with wall thickness <1.5 mm	New tubes only; typical minimum wall thickness >3 mm	New tubes and membrane walls only; typical minimum wall thickness >3 mm
Thermal-shock resistance	Low	High	High
Repairability	Coatings can be repaired on-site, either locally or over larger areas, or fully removed and reapplied	Repair is possible in principle, though on-site access is often limited (e.g. superheater bundles)	Laser-clad layers can be repaired in the same way as other welded coatings
Execution	Workshop / on-site	Workshop	Workshop
Deposition rate	Arc spraying: very high; plasma spraying: high	High	Considerably higher than other welding processes
Temperature resistance (max. coating surface temperature)	Material-dependent; FeCr alloys withstand continuous service up to 900 °C	Typical nickel-base alloys withstand continuous service up to approx. 700 °C	INCONEL™ alloys are suitable for continuous service up to approx. 550 °C
Typical applications	Membrane walls, refuse chutes, screw conveyors, apparatus and vessels	Evaporator and superheater tubes, soot-blower tubes	Membrane walls, headers, soot-blower tubes, industrial valves and fittings

Laser Cladding vs. Weld Overlay

Laser cladding using INCONEL™-base alloys offers all the welding and machining characteristics of conventionally weld-overlaid membrane walls, ensuring full compatibility. Layers can be overlap-welded, studs and pins can be applied, and site damage can be repaired — all without requiring additional qualifications for installation personnel. Benefits such as reduced downtime and lower material consumption can cut weld-preparation effort and cost by up to 30%, making laser cladding a commercially attractive option.

	LaserCladding	Weld Overlay
Process	Thermal spraying	Welding
Execution	Workshop only	Workshop and on-site
Cooling required	Not required — heat input is minimal	Water cooling of tubes is mandatory for quality assurance
Surface preparation	Glass bead / grit blasting	Glass bead / grit blasting
Coating thickness	Single layer, 0.5–1 mm; standard thickness: 1 mm	Single or multiple layers, 0.8–2.4 mm; standard thickness: 2 mm
Iron content	≤3% at 0.5 mm	<8% at 0.8 mm
Dilution zone thickness	Approx. 0.15–0.3 mm	Approx. 0.4–0.9 mm
On-site handling	Laser-clad layers can be processed in the same way as weld-overlaid layers. Laser cladding can readily be combined with (manual) on-site welding	On-site welded installation is straightforward
Surface structure	Linear structure; overlapping lines	Scaly structure; overlapping weld passes

Coating Processes

Arc Spraying

The arc spraying process uses direct current to melt the tips of two wires that are fed together into a spray gun, via the resulting electric arc. The molten droplets are accelerated by an atomising gas to speeds of up to 150 m/s and propelled onto the previously roughened surface. There, they solidify, mechanically interlock with the substrate, and form a dense, lamellar protective layer. These coatings are characterised by high bond strength and excellent durability.

Cored wires enable the processing of a wide range of materials and alloys

Innovative cored wires — which encapsulate coating materials within stainless steel or nickel-chromium sheaths — make it possible to process materials and alloys that could not previously be manufactured in solid wire form. This opens up a broad spectrum of applications for corrosion and wear protection.

Processing of nickel-base materials and extremely wear-resistant alloys

Häuser & Co uses arc spraying to process nickel-base materials as well as extremely wear-resistant materials such as iron-chromium alloys with a hardness of 950–1050 HV and temperature resistance up to 900 °C.

Coatings applied even under demanding conditions



A further advantage of the process is the robust and compact equipment design, which also supports mobile applications. This allows coatings to be applied even under demanding site conditions — such as inside boilers — significantly extending the service life of corroded wall surfaces.

Plasma Spraying

The powder-based plasma spraying process uses an extremely high-energy electric arc to ionise an inert gas — typically argon — into a plasma state. The gas reaches temperatures of approximately 18,000 °C, expands to roughly 100 times its original volume, and is accelerated to supersonic speed by the design of the spray gun. The coating material, in powder form, is injected into the plasma and melts within milliseconds. It exits the gun at high velocity in a molten state and mechanically bonds to the previously roughened surface. Because the plasma recombines rapidly after leaving the gun, the component temperature remains low throughout the process (max. 80–100 °C), preventing material distortion.



Almost all metallic and ceramic materials can be processed

The resulting coatings are characterised by high bond strength, low porosity and minimal oxidation tendency. Thanks to the extreme temperatures generated within the plasma, virtually all metallic and ceramic materials can be processed, provided they can be produced in powder form and have a defined melting point. This gives the process exceptional material versatility and flexibility.

Process optimisation through post-application heat treatment

Häuser & Co has further refined the plasma spraying process through post-application heat treatment of the coatings. This innovation creates a metallurgical bond between coating and substrate, making delamination or undercutting virtually impossible. In addition, the coating remains entirely free of iron contamination from the base material. The desired corrosion- and wear-protection properties are retained consistently throughout the full coating thickness, resulting in a particularly durable and reliable coating.

The Häuser Process — LaserCladding

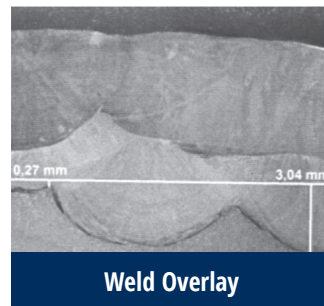
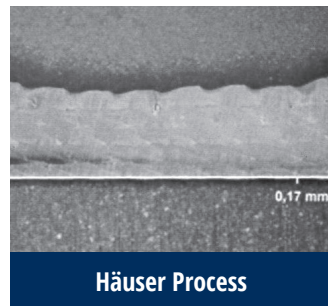
The Häuser process is our in-house-developed laser powder-coating technique (LaserCladding).

A laser beam is used to fuse the powdered coating material — typically INCONEL™ 625 or 686 — onto the component surface. The resulting metallurgical bond with the base material's surface prevents later coating failure due to undercutting or delamination.

The coating exhibits very high homogeneity and purity of the specified coating material across its full thickness. The dilution and contamination of the coating material with elements from the base metal — a well-known issue in conventional welding — occurs only to a minimal extent.

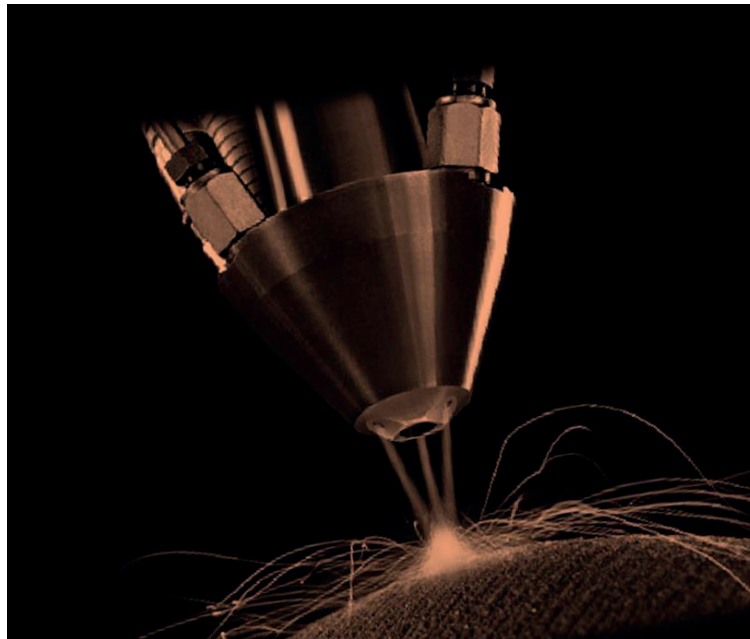
+ With conventional weld overlay, dilution effects mean that a second, „pure“ protective layer must be applied in an additional working step.

With the Häuser process, a single coating layer already meets the requirements for purity and effective coating thickness.



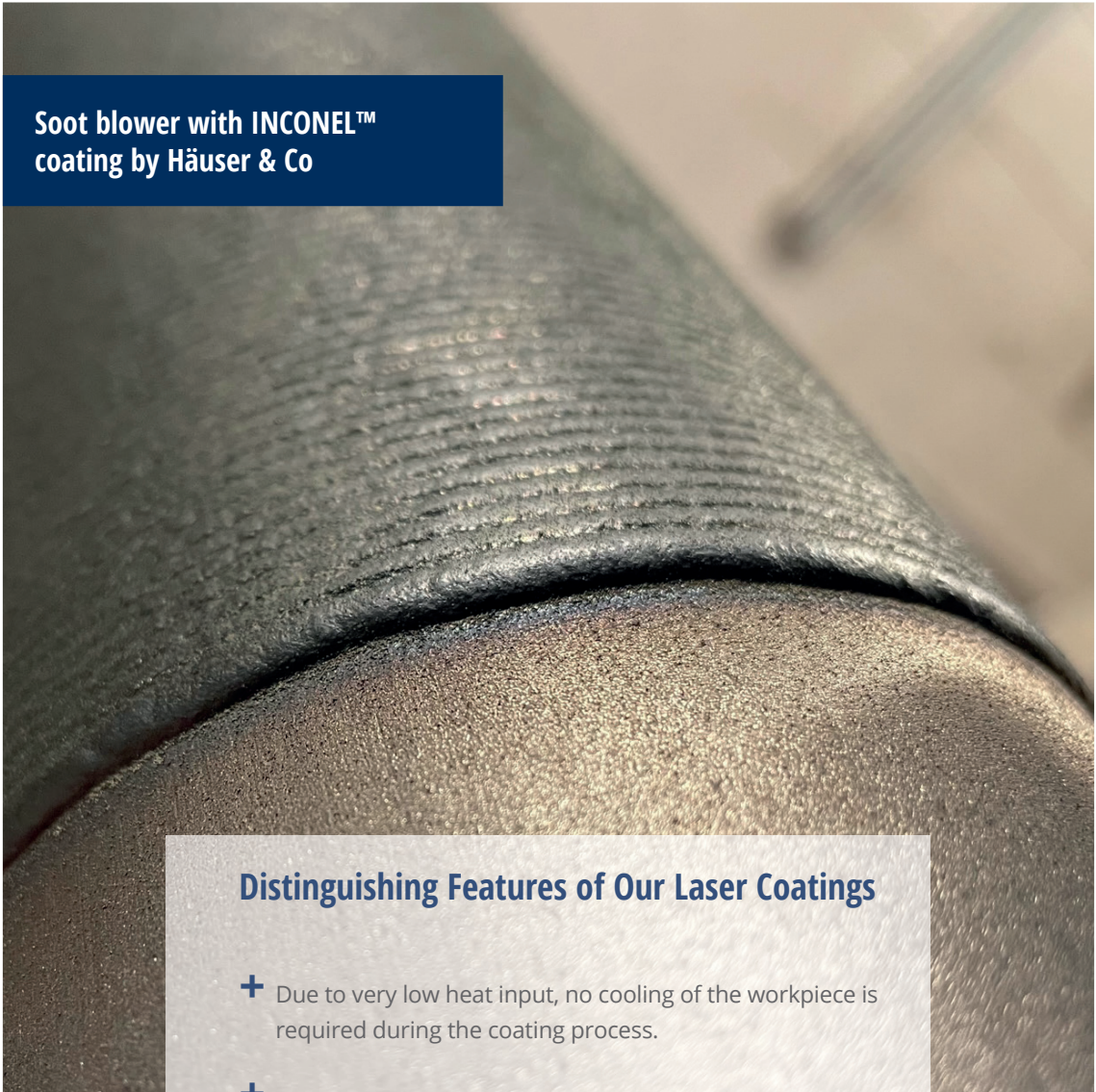
+ Coatings applied using the Häuser process (left) exhibit a significantly more homogeneous and smoother surface finish.





Advantages of the Häuser Process

- + Coating thickness — and the associated cost of applying high-value materials — can be optimised.
- + Häuser-process coatings increase the load-bearing capacity of membrane walls, reduce the risk of unplanned shutdowns, and improve plant availability.
- + Thanks to their uniform, linear surface structure, Häuser-process coatings are particularly well suited to applications in fluidised-bed boilers.
- + Membrane wall service life can be multiplied through coating, effectively reducing repair costs.
- + In replacement or repair scenarios, transitions to existing material are coated using weld-overlay techniques.
- + Integration or combination with existing cladding is straightforward, owing to the materials used and the metallurgical bond achieved.
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Soot blower with INCONEL™
coating by Häuser & Co

Distinguishing Features of Our Laser Coatings

- + Due to very low heat input, no cooling of the workpiece is required during the coating process.
- + Our laser coating is applied to soot-blower tubes that are ready for installation. This eliminates quality issues arising from poorly executed welds caused by nickel contamination of the weld pool.
- + Customers can also have soot-blower tubes already in stock coated retrospectively.
- + Different coating materials can be selected depending on installation position and load profile.
- + The process is particularly well suited to stainless steels, which tend to distort under other welding processes.
- + The very narrow dilution zone allows coating thicknesses from approximately 0.5 mm with minimal iron content.

Case Studies from Practice



Plasma-Coated Superheater Tubes: Significant Service-Life Extension at a Waste-to-Energy Plant

At a waste-to-energy plant (40 bar, 400 °C), superheater tubes located after the flue-gas deflection into the third pass had a service life of only around 18 months at flue gas temperatures of 560–650 °C. A soot blower further accelerated wear on the first rows of tubes. Protective shields showed no improvement, which led to the installation of plasma-coated trial tubes (HS 52, 0.8 mm coating thickness) in 2005. The positive results led, from 2008 onwards, to the replacement of the final superheaters across all four boilers, increasing service life to at least 6 years.

Innovative Laser Coating at a Municipal Waste Incineration Plant: Efficient Boiler Protection Enabling Capacity Increases

A municipal waste incineration plant processing 975,000 tonnes of household waste and sewage sludge annually is evaluating options to increase the output of its ageing boiler units by reducing the refractory lining to enlarge the heating surfaces. The membrane walls exposed as a result must be protected against corrosion and wear.

In 2020, a laser-clad test area was installed in one of the boilers (40 bar, 400 °C). The 1 mm laser-cladding layer sits beneath a 2 mm weld overlay, in a section with flue gas temperatures of 850–900 °C. Inspections after 8,000, 20,000 and 32,000 operating hours revealed no damage or material loss. The ongoing field trial confirms that the 1 mm INCONEL™ coating effectively protects evaporator heating surfaces.



Efficient Protection and Optimised Service Life

At a waste-to-energy plant operating six lines with a combined capacity of 450,000 tonnes of waste per year, superheater tubes at the transition from the combustion chamber to the second pass were subject to particularly high stress, with temperatures reaching up to 1,000 °C alongside corrosion and abrasion. To extend the service life of the 13CrMo4-5 tubes, plasma-coated trial tubes using a nickel-base alloy (HS 52/HS 4) were first installed in 2011. This coating provides excellent corrosion and wear protection at a hardness of 560–640 HV. Following a five-year trial period during which tube service life was doubled, plasma-coated tubes were introduced as standard from 2016 onwards, significantly reducing both tube replacements and downtime.

In 2014, a laser-coated membrane wall was installed for the first time in the front wall of the combustion chamber at a German waste-to-energy plant. The long-term trial, still ongoing after more than 75,000 operating hours, confirms the effectiveness of the laser-cladding process, demonstrating strong field performance with a coating thickness of just 1 mm.

Communication at Eye Level

Experienced Power Plant Professionals

With decades of hands-on experience in power plant operations — including roles as plant manager and technical director — we understand the demands of day-to-day operations from first-hand practical experience.

Operating Data

Combining your operating data — temperatures (boiler, flue gas), pressure (steam, feedwater), flue gas composition (oxygen, NO_x , SO_2), water quality and flow rates — provides a clear picture of operating conditions and the stresses your components are subject to. This information, together with plant-specific factors such as the position and design of soot blowers, is essential for analysing your individual challenge and developing a suitable coating solution.

Boiler Inspection

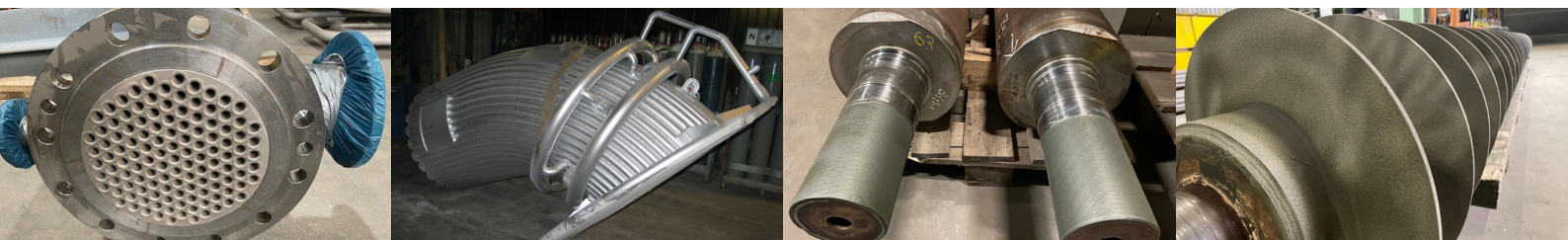
On-site inspection and documentation ensure complete, consistent recording of inspection findings, maintenance measures and optimisation recommendations, safeguarding the long-term performance and protective effect of the coating.

Diverse Coating Solutions for Heavy Industry

Our expertise extends well beyond coating membrane walls and tubes. A few examples:

- + Heat exchangers: Bespoke solutions for customers in the chemical industry.
- + Cleaning systems: High-performance traverse tube systems made from material 1.4713 („Sicromal 8“, a heat-resistant ferritic chromium steel) for efficient cleaning of superheater tubes in lignite-fired boilers.
- + Roll journals: Robust coatings for demanding applications in the steel industry.
- + Flue gas elbows: Reliable protection for components in the metallurgical industry.

Whether in power generation, chemicals, steel or metallurgy — we offer innovative coating solutions tailored to the specific challenges of your industry.



An Innovation-Driven Company

With over 30 years of experience in the thermal spraying of metallic and ceramic materials for a wide range of industrial applications, Häuser & Co GmbH has built up extensive expertise in what a coating designed for high-temperature service must deliver. Yet processes — and with them the underlying requirements — are continuously evolving.

For this reason, we don't just offer application-specific alloys and coating solutions to our customers — we continue to develop existing coating techniques and materials in a practical, hands-on way, working closely alongside our customers.

This close collaboration results in practical coating solutions, tailored as closely as possible to each customer's specific requirements and benefit.

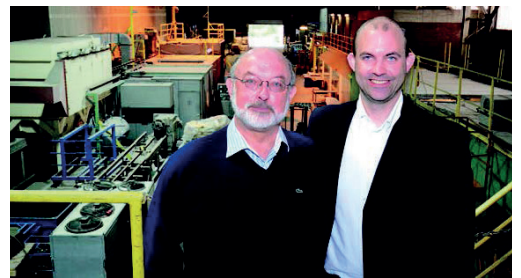
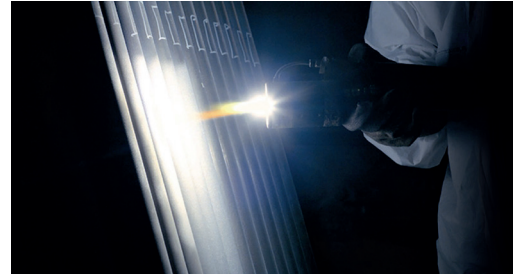
The laser spraying process, in use at our company since 2014, allows us to apply well-established materials and alloys — such as HASTELLOYS™, INCONEL™ 625/686 or STELLITE™ 21 — to components via a fusion bond. With very low dilution, we achieve high purity and homogeneity, making the most of each material's technical advantages.



1995

While working for Thyssen AG, Bodo Häuser developed an on-site coating process for high-stress components using plasma spraying.

In 1995, he acquired this patent from his employer and, drawing on his extensive experience in both industry and research, founded what is today Häuser & Co GmbH.



2006

Now in its second generation, Hendrik Häuser has been with the company since 2006, and has served as Managing Director since 2014 — securing the long-term future of Häuser & Co GmbH as a traditional, owner-managed family business.

2013

Building on its state-of-the-art laser spraying process, Häuser & Co GmbH develops entirely new products and applications for surface optimisation and enhancement. A notable example is the patent application for coating membrane walls with nickel-base materials as an alternative to conventional weld overlay.



HÄUSER & CO

Thermal spraying processes
for metallic and ceramic materials

www.haeuser-co.de

