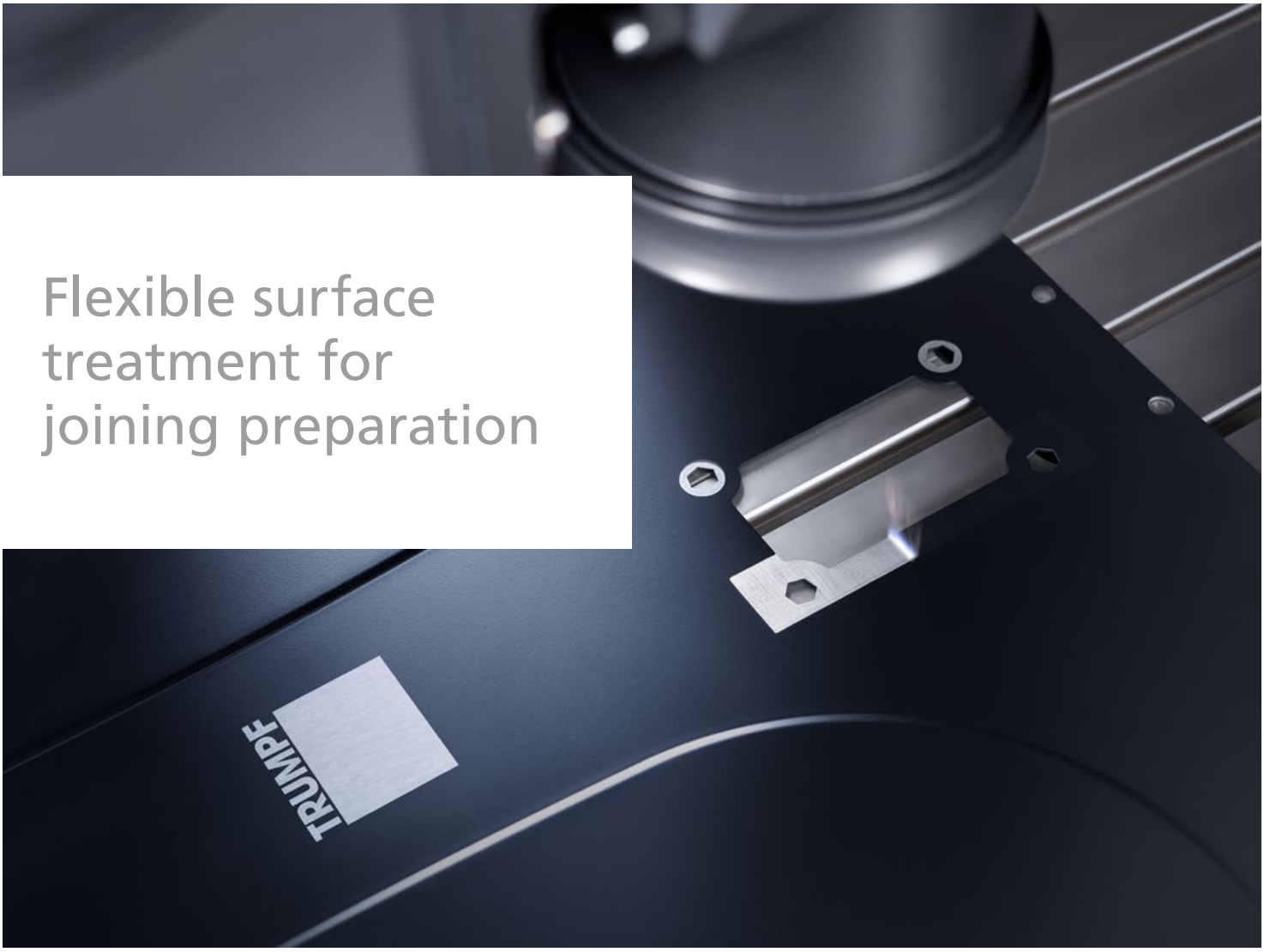


Flexible surface treatment for joining preparation

Whether it's cleaning, paint removal or structuring – the laser can easily and swiftly process surfaces of various dimensions. Due to increasing demands on joining processes, surface pretreatments are indispensable. Our laser portfolio offers a wide range of different beam sources with precisely adjustable laser powers and properties.

Flexible

The laser can be used with great flexibility, even in 3D. Thanks to tool-free, non-contact processing, mechanical wear is a thing of the past.

Versatile

Whether steel, copper or aluminum – a great number of highly diverse materials can be processed with the laser tool.

Reproducible

The laser impresses with its high throughput and fast cycle times with reproducible results.

Accurate

The laser enables a controlled, selective and precise process.

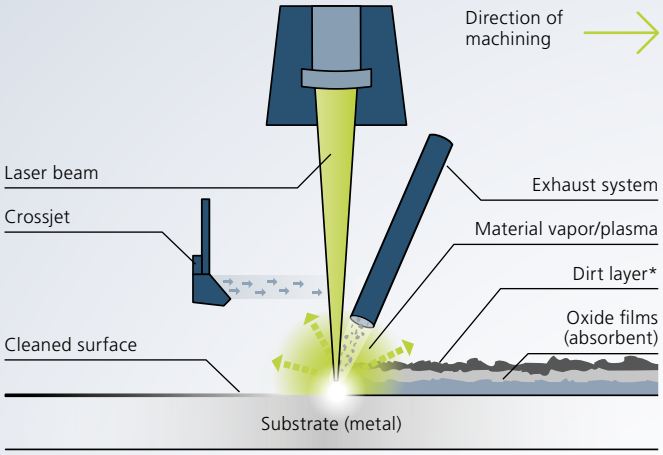
TRUMPF

Machine tools/Power tools
Laser technology/Electronics

Process principles

Laser cleaning

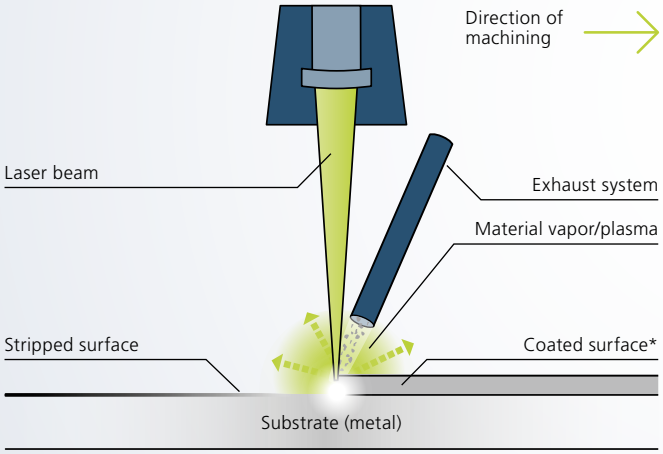
- Pulse by pulse, the focused laser beam removes impurities such as oxidation and functional layers. The laser vaporizes the undesirable layers using very high peak pulse power, in an extremely gentle, non-contact manner.
- The laser pulses have virtually no thermal effect on the workpiece surface, which prevents distortion or damage and changes to the material.



* Dirt layer such as greases, oils, etc. (partially absorbent).

Laser paint removal

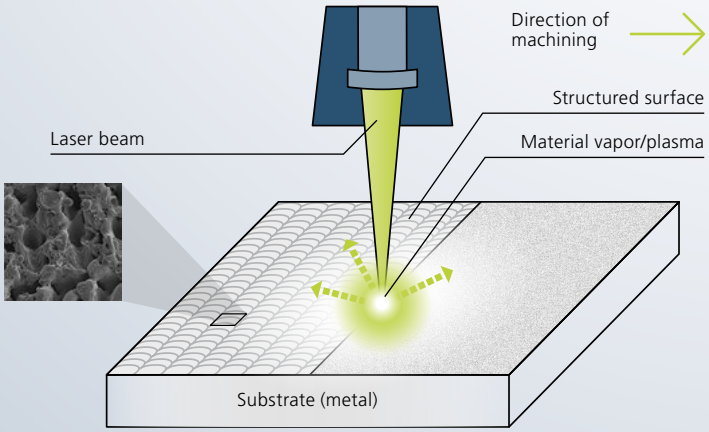
- In laser paint removal or laser ablation, the functional layer to be removed is selectively removed from a surface using the laser beam.
- The absorbing material is heated and vaporized or sublimated by the laser energy.
- The laser pulses have virtually no thermal effect on the workpiece surface; this prevents distortion, damage and changes to the material. Only the coating is removed.



* Coated surface such as a zinc coating or cathodic dip painting.

Laser structuring

- In laser structuring, regularly arranged geometric structures are reproducibly created on surfaces using pulsed laser radiation.
- The laser beam melts the material in a controlled manner which then solidifies to a defined structure.

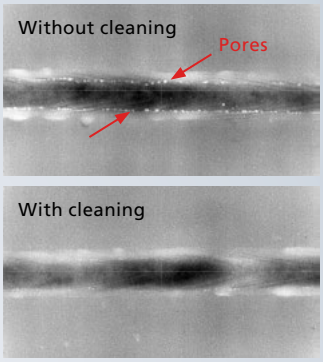


Scan the QR code for more information:

Application examples

Welding preparation

A clean surface is a prerequisite for successful and long-lasting weld connection. In order to meet the requirements for steel and aluminum, the weld seams must not have any imperfections or irregularities such as pores. Increasing porosity leads to reduced weld seam strength and to leaks. Spatter and porosity are caused by residual lubricants such as greases and oils as well as rust and other oxides, among other things. These potential contaminants can be removed by an upstream laser cleaning process before welding.



Cross-section of laser-welded aluminum sheets with and without laser cleaning ($AlMn_1Cu$ + $AlMg_3$).

Laser-cleaned differential bevel gear with prepared seam point.

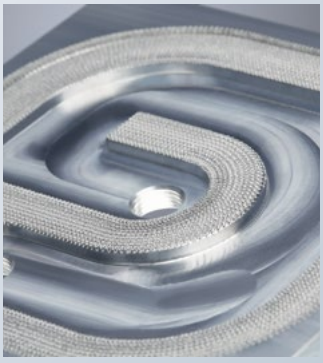
Adhesive bonding preparation

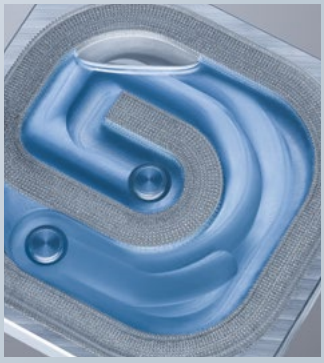
In adhesive bonding, surface pretreatment and preparation with the laser is an important part of the process chain and an effective and environmentally friendly alternative to conventional preparation methods. In adhesive bonding preparation, the laser cleans the surface of dirt and oxides. In the same process step, the surface chemistry is modified and a defined structuring created, thus the binding property and long-term stability are improved.

Better adhesion and long-term stability of the adhesive bond through laser cleaning and structuring using the example of a battery pack. Cleaning and structuring: TRUMPF; adhesive: DELO.

Metal-plastic connection

Direct thermal joining enables metal-plastic connections in a two-stage process. In the first step, the metal surface of the joining partner is structured with a pulsed laser. The surface structures created are the requirement for the plastic partner, to flow into or grip the metal surface. In the second step, the metal surface is heated by induction so that the plastic melts at the boundary surface. The molten plastic is wetted by pressing it against the metal partner. With these two steps, a mechanical connection is created.





Structuring for frictional and form-locking connections using the example of battery system cooling in the battery pack.

Matching products

For cleaning, ablating or structuring, pulsed solid-state lasers in the nanosecond range such as the laser sources TruPulse nano and TruMicro 7000 are typically used. In terms of beam formation and repetition rate, the short-pulse lasers of the TruMicro Series 7000 are particularly suited for the large-area ablation of coatings, paints and impurities, as well as for structuring. The TruMark and TruPulse nano lasers work efficiently as cleaning or structuring tools, also for smaller surfaces.

TruMicro Series 7000

For large areas and for maximizing productivity

The operating principle of the high-power short-pulse lasers ensures a constant pulse duration over the entire repetition rate range. This means that the pulse energy and pulse frequency of the laser being used can be adjusted to the optimized beam shape. Laser stations enable lasers from the TruMicro Series 7000 to be connected upstream of existing processing lines with ease. The laser offers up to four beam outputs and can be connected to several optics systems via laser light cables, which maximizes utilization.

TruMicro Series 7000		
Laser power	kW	Up to 2
Intensity distribution		TopHat
Pulse duration	ns	30 ±5
Pulse energy	mJ	100
Pulse repetition frequency	kHz	5–200
Round and rectangular fiber	µm	Up to 600

TruMark + TruPulse nano Series

Efficient and flexible cleaning or structuring tools

The compact and flexible lasers are used in a variety of industrial applications and for a wide range of materials. They offer users unrivaled flexibility and are suited for micro-structuring as well as the ablation of functional layers and conventional markings – even for occasional use. In addition to the laser, the TruMark Series also offers a scanner, cooler, marking software or image processing and can be easily integrated into a TruMark Station. The TruPulse nano lasers are particularly suited as a flexible beam source for easy integration in existing systems.

TruMark + TruPulse nano Series		
Laser power	W	Up to 300
Intensity distribution		Similar to Gauss
Pulse energy	mJ	1.5–5
Pulse repetition frequency	kHz	1–4000

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