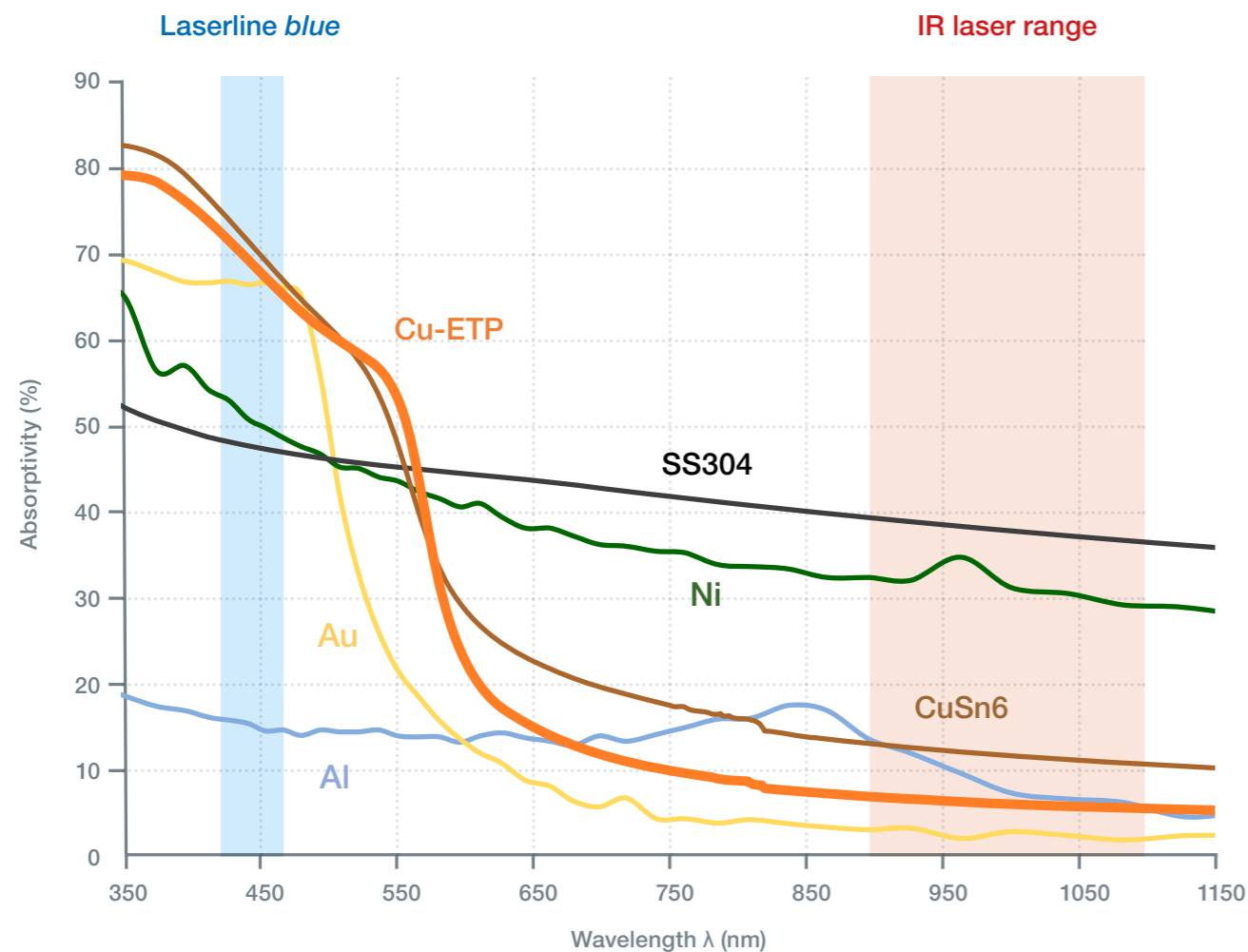
A close-up photograph of a laser cutting process. A bright blue laser beam is focused on the edge of a thick, cylindrical metal pipe. The pipe has a rough, textured surface. The laser beam creates a bright, intense light at the point of contact, with a blue glow emanating from the cut. The background is dark, making the laser and the pipe stand out.

Laserline blue
A New Dimension
in Material Processing

The Challenge

Low energy absorption of highly reflective metals such as copper or gold in the 1,000 nm wavelength range poses major challenges for standard IR lasers. The required high initial intensities induce processes often characterized by turbulent melt pools and spatter formation, that are critical factors in the processing of electrical components.



Absorptivity of various metals at ambient temperature.
Sources: Fraunhofer ILT, Hummel et al., Journal of Adv. J. Proc. 1, 2020
Nasa, E. Spiesz et al., Nasa Technical Note TN-5353, 1969

The Solution

Laserline's blue high power diode laser series revolutionizes the processing of copper, and other precious metals in various ways. With approximately 445 nm, these lasers offer the ideal wavelength for the laser processing of highly reflective metals. Multiple times higher absorption allows significantly lower intensities and larger laser spots.



Up to 6,000 W cw available laser power supports controlled heat conduction welding, keyhole welding, cladding and additive manufacturing processes.

Industry Proven System Concept

Blue diode lasers are based on our product families and have been established in industrial applications for many years. They offer the most compact visible lasers in this power class.

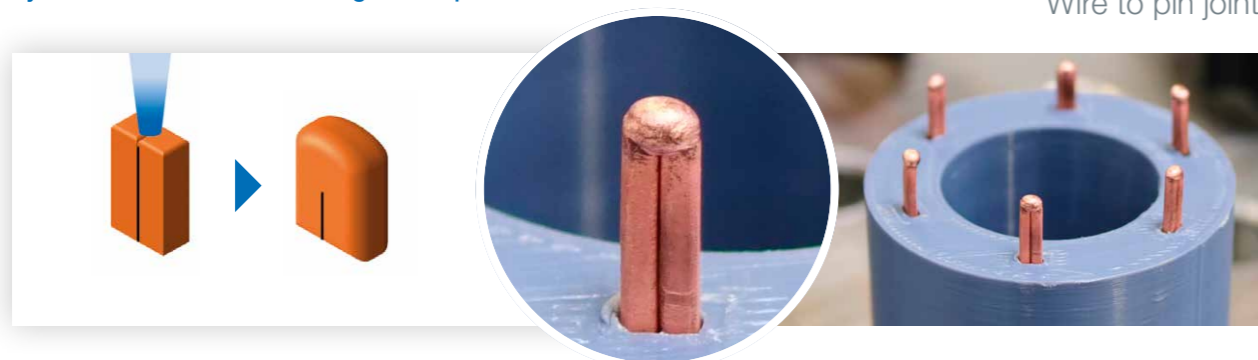
The absorption in copper and thus the process efficiency, is increased multiple times compared to IR lasers. This results in smooth, robust and spatter-free welding processes of electrical connectors.

The generation of up to 6,000 W cw blue laser light straight out of laser diodes is unique for industrial lasers. This technology prevents complex and inefficient wavelength conversions.

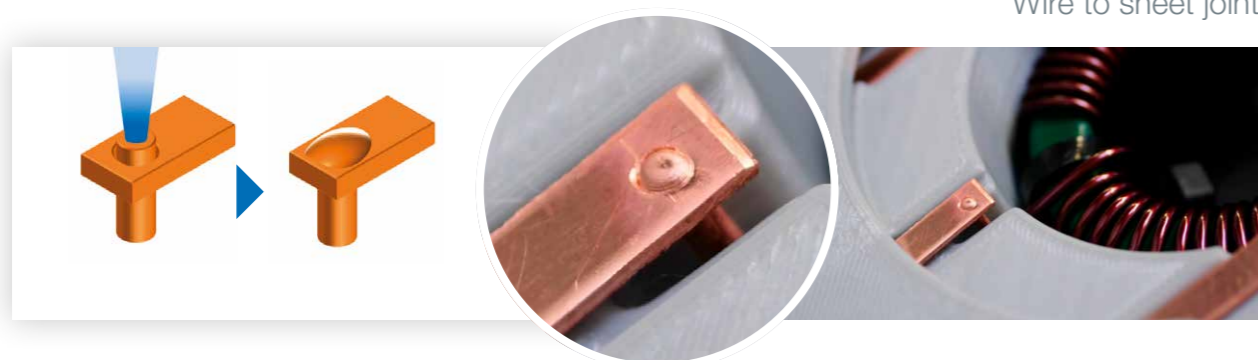
Technical advantages at a glance

- > Up to 6,000 W cw power at approx. 445 nm
- > Scanner or fixed optic solutions provided for optimal beam delivery
- > Improved absorption on highly reflective metals
- > Industry proven system architecture
- > Highly stable process with calm melt pool characteristics
- > Beam switch option

Various copper connector joint types are easily weldable by blue diode lasers with a single laser pulse:



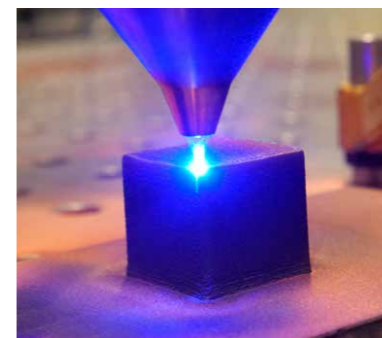
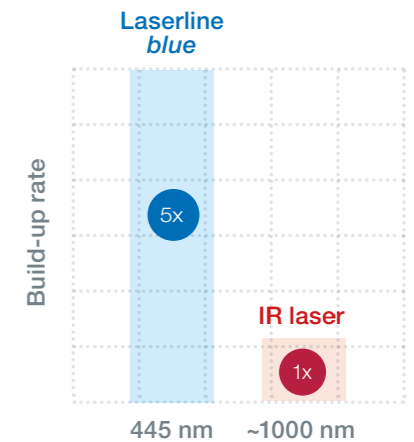
Wire to pin joint



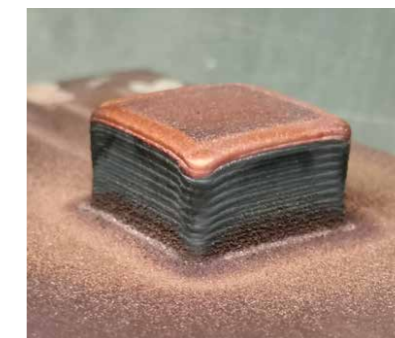
Wire to sheet joint

Additive Manufacturing with Copper and its Alloys

- > At least 5 times higher build-up rates compared to IR lasers
- > Stable process for AM with pure copper and its alloys
- > About 20% more efficient process for Stainless steel, Ni- & Co-alloys



Powder efficiency: > 80%



Build up: pure copper bulk material

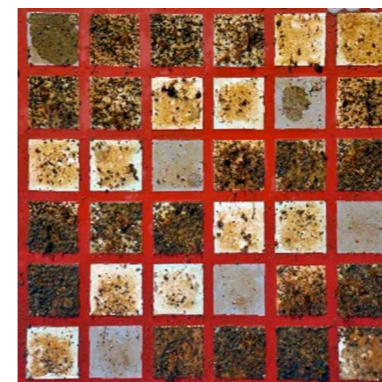


Density: > 99.8%

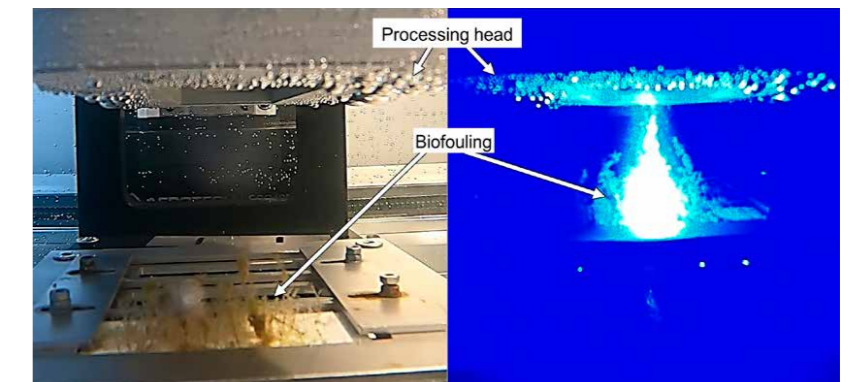
Supported by DMG MORI Ultrasonic LaserTec GmbH

Underwater Irradiation with Blue Diode Lasers

- > Blue wavelength propagates perfectly in water
- > Underwater irradiation with laser enables a number of heat and bio-chemical processes
- > One example is the removal of stubborn fouling on maritime surfaces (left)
- > Cleaning process is more gentle, environmentally friendly and also more efficient than conventional cleanings
- > The blue laser light of a Laserline LDMblue has a cell-damaging effect
- > The aim is to damage settled marine organisms to an extent that the fouling is washed away by the current

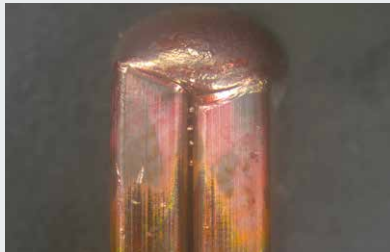
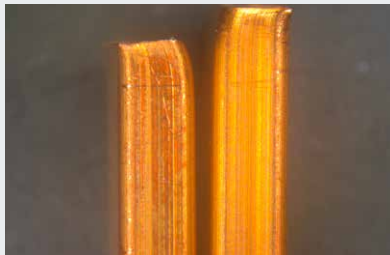
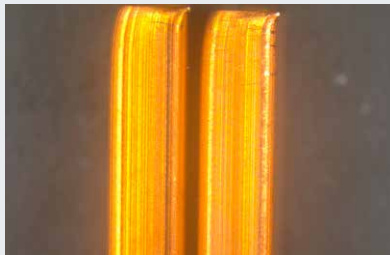


Maritime fouling on samples
Source: Fraunhofer IFAM



Underwater laser process in side view: Laser off (left) and on (right)
Source: LZH

Blue Processing Examples



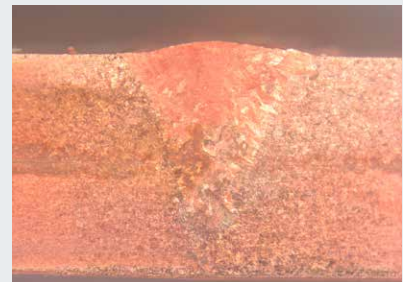
Hairpin welding: Easy and robust process due to high absorptivity and large spot size. Overcoming gaps, misalignments and part tolerances.



Thick copper welding: Electrical connection with edge joint.



Dissimilar materials: Joining of gold coated foil to copper plate.



Thick copper welding: Electrical connection in overlap.

Laserline Blue Diode Lasers at a Glance

Max. output power (cw)*	800 W	1,800 W	2,000 W	2,000 W	5,000 W	6,000 W
Beam quality	20 mm.mrad	30 mm.mrad	60 mm.mrad	20 mm.mrad	30 mm.mrad	60 mm.mrad
Product series	LDM <i>blue</i>			LDF <i>blue</i>		
	Other laser powers and process-adapted beam qualities available.					
Wavelength range	445 nm ± 20 nm					

*Power specification at the output of a 5 m fiber.

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