



Laser metal deposition

Tapping  
new potential  
with deposition  
techniques

# Simple principle – broad application

In laser metal deposition, laser light melts powder to form preprogrammed geometries in the desired alloys and coatings. The technique can be used for repairs, additive manufacturing, coatings, and gap filling during welding. It is a simple principle with broad application – no wonder, then, that it has become popular in a variety of industries.



## Aerospace

Repair costly and complex components such as blades and housings.



## Heavy industry and energy

Coat drills, shafts, and gas turbine components to protect against wear, corrosion, and the need for repairs.



## Automotive

Provide components with localized reinforcement and achieve a better welding seal (for instance in electric motors), even when there are gaps to be bridged.



## Research and development

Develop new alloys and material combinations, and produce 3D prototypes and components using additive techniques.



## Construction and agricultural machinery

Protective coatings extend service life, for instance in chaff cutters.



## Consumer goods

Take advantage of wear protection and 3D-printed structures to improve electric and thermal conductivity.



## Tool making

A protective coating safeguards parts against wear and the need for repair.



## Medicine

Coat prostheses and medical tools with additional, biocompatible materials.



## Contract manufacturers

Finish surfaces and manufacture components using additive techniques. Laser metal deposition complements existing surface treatment methods.

## What is laser metal deposition?

Laser metal deposition is a generative manufacturing technique for metals. Laser metal deposition (LMD) is the most common term for the technique, though some refer to “direct metal deposition” (DMD) or “direct energy deposition” (DED).

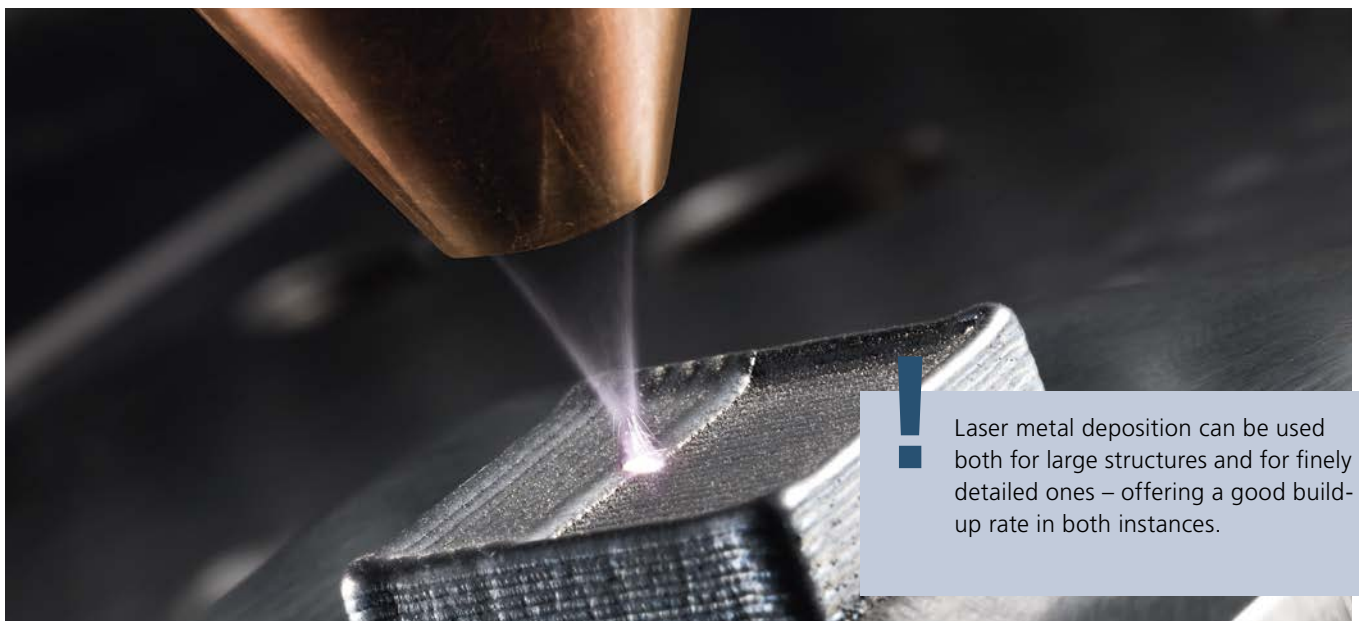
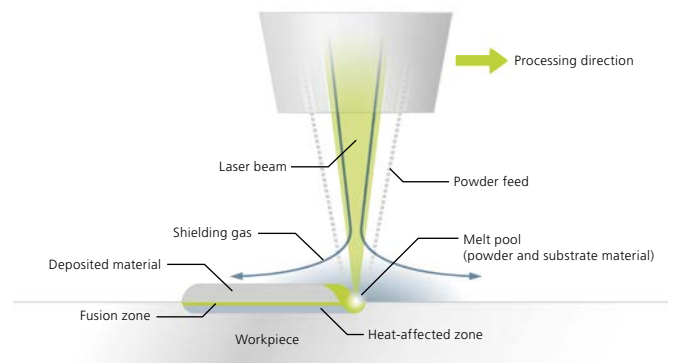
The principle is simple: A laser beam is used to generate a molten bed, to which an additional material is added. The laser then fuses the surface of the component with the additional material.

As a result, the coating and the component or existing coatings are fused with a metallurgical bond. The metal powder is added to the base material, layer by layer, and fuses with the substrate so that the final product is nonporous and crack-free. What is special is that you can use the technique to systematically build up multiple similar or even non-similar metal coatings.

## Which materials can you use?

Standard workpiece materials*	Potential coating materials*
Tool steels/hardened steels/tempering steels	Tool steels/corrosion-resistant steels
Cast iron	Nickel alloys
Construction steel/cast steel	Cobalt alloys
Nickel alloys	Titanium alloys
Titanium alloys	Tungsten/titanium carbides
Aluminum	Aluminum
Copper	Copper

\* Further materials are possible on request.



# A versatile technique

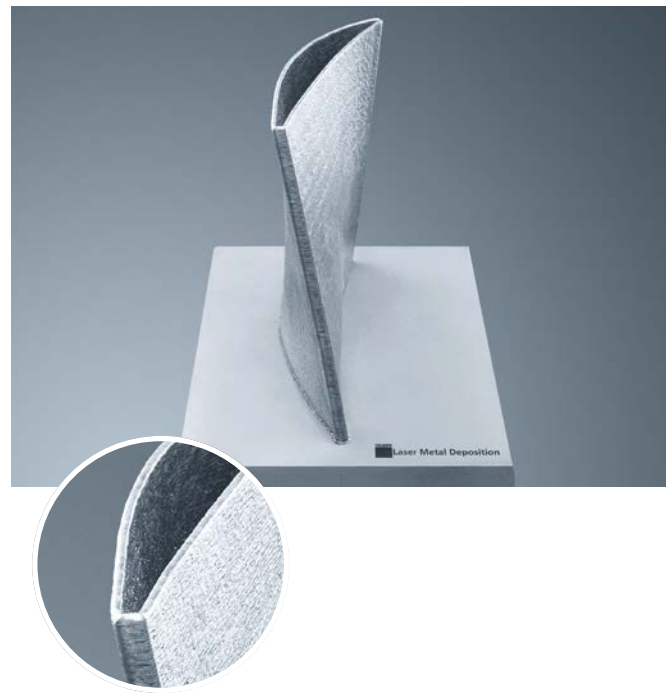
Laser metal deposition offers a fully industry-ready alternative to disposing of valuable components. Using this technique, you can repair parts, functionalize and finish surfaces, alter geometries without the need for machining, and manufacture 3D structures and components that just wouldn't be possible using other methods.



## Repair, repurpose, reuse

### Repairs

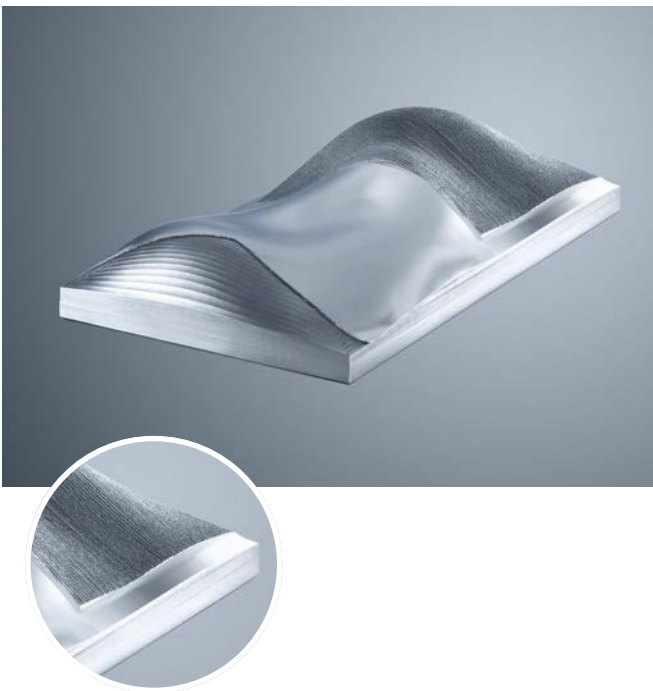
Are you looking for more added value? Use LMD to repair expensive components and tools with ease. LMD can repair both minor and major damage quickly and almost without a trace – ensuring that your component or tool is soon back in action. You can also use the technique to make design changes – saving a huge amount of time, energy, and materials, especially when it comes to expensive metals such as nickel or titanium. Typical applications include turbine blades, pistons, valves, shafts, and tools of all kinds.



## Freedom of form

### Additive manufacturing

Additive manufacturing using LMD provides considerable design freedom, even in the case of delicate and highly complex geometries. Create components from scratch or add 3D structures to base shapes. An example of this is the fan blade shown in the above illustration. It was developed in the EU project AMAZE. Getting started with LMD is easy: as one of TRUMPF's industrial additive technologies, LMD is a fully industry-ready technique that draws on tried-and-tested lasers and machines. Experience the speed and cost benefits for yourself – not to mention the extensive design possibilities. Combine different materials into sandwich structures, use specific alloys or create your own.



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## A long life

### Coating

Upgrade your tools with a coating to protect against wear or corrosion. LMD coatings toughen your components and make them resistant to saltwater, chemicals, or weathering according to your needs. LMD allows for a wide range of material combinations and coating structures. Save on production costs, for instance, by using cheap materials for the component itself and then providing it with a high-quality coating.



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## Goodbye cracks

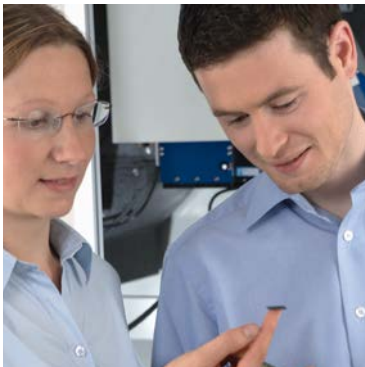
### Joining

LMD can also be used in joining – for instance, to fill gaps of several millimeters. This results in close, homogenous seams, without the need for any post-processing. Because the powder deposition is coaxial, the LMD joining process is three-dimensional and direction-independent, making your process chain especially flexible. LMD is suitable for joining a range of materials, such as steel and cast aluminum, for instance in battery, electric motor, and powertrain components.

# Get started

Benefit from tried-and-tested laser beam sources and machines for LMD, all from a single source. We put together a turnkey system tailored to your exact activities and batch sizes – so you can get started right away.

## Application consulting



What do you want to solve with LMD? Special application advisors and fully equipped application laboratories support you in choosing materials, defining parameters, and configuring your system. You can also take advantage of our training events.

## TruLaser Cell 3000



From prototype to full-scale production: with this 3-in-1 machine, you can process small and medium-sized components extremely efficiently. The machine is equipped for laser metal deposition (LMD) as well as laser cutting and welding in 2D and 3D. Process adapters make it particularly easy to switch between techniques.

## TruDisk



Because of their beam quality, the TruDisk disk lasers are ideal for delicate tasks. Put your trust in a broad portfolio of the world's most powerful fiber-guided disk lasers.

## TruLaser Cell 7000



Similarly compact and modular in design, the "big sister" to the TruLaser 3000 provides more performance and more processing space for larger components. Switching between LMD and laser cutting and welding is quick and easy.

## TruDiode



TRUMPF diode lasers are particularly energy efficient – while still offering the best, reproducible results. Cut your operating costs with the cost-effective TruDiode.

## TruLaser Weld 5000



Process medium-sized and large parts with flexibility using a single system: this automated robot can employ LMD as well as other laser welding techniques.

## Integrate LMD yourself

Get the best equipment for LMD for your own system – the ideal solution for OEMs and integrators. DepositionLine comprises a traveling powder conveyor, the powder conveyor line, and the processing optics complete with powder nozzle. We are also happy to fit the powder conveyor with up to four independent containers. Depending on the application, you can operate the system using a TruDisk or a TruDiode laser.



BEO D 70 is a tried-and-tested optical system that features programmable motor-driven focusing and a digital camera for even greater process safety. The powder nozzles have been developed specifically for the technique, and allow for optimal distribution of the powder flow.



The powder conveyor takes the powder-gas mixture out of the containers and supplies it to the nozzle. It is capable of handling even tiny amounts of powder and the finest grains.

## We are there for you

From application consulting and training events to the prompt delivery of replacement parts, TRUMPF offers a range of tailored services that cover the entire life cycle of your laser or laser system. This allows you to use your laser or laser system to the full and manufacture even more productively. Make use of our worldwide training centers, for instance, or arrange an individual training session at your own location. With a suitable service agreement, you maximize the availability of your laser or laser system – select a package tailored to your wishes out of our comprehensive Services portfolio.



Application  
consulting

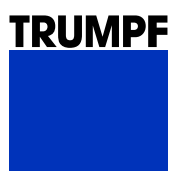
Maintenance

Trouble-  
shooting

Spare parts

Feature  
enhancements

TRUMPF is certified to ISO 9001:2008  
(find out more at [www.trumpf.info/quality](http://www.trumpf.info/quality))



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