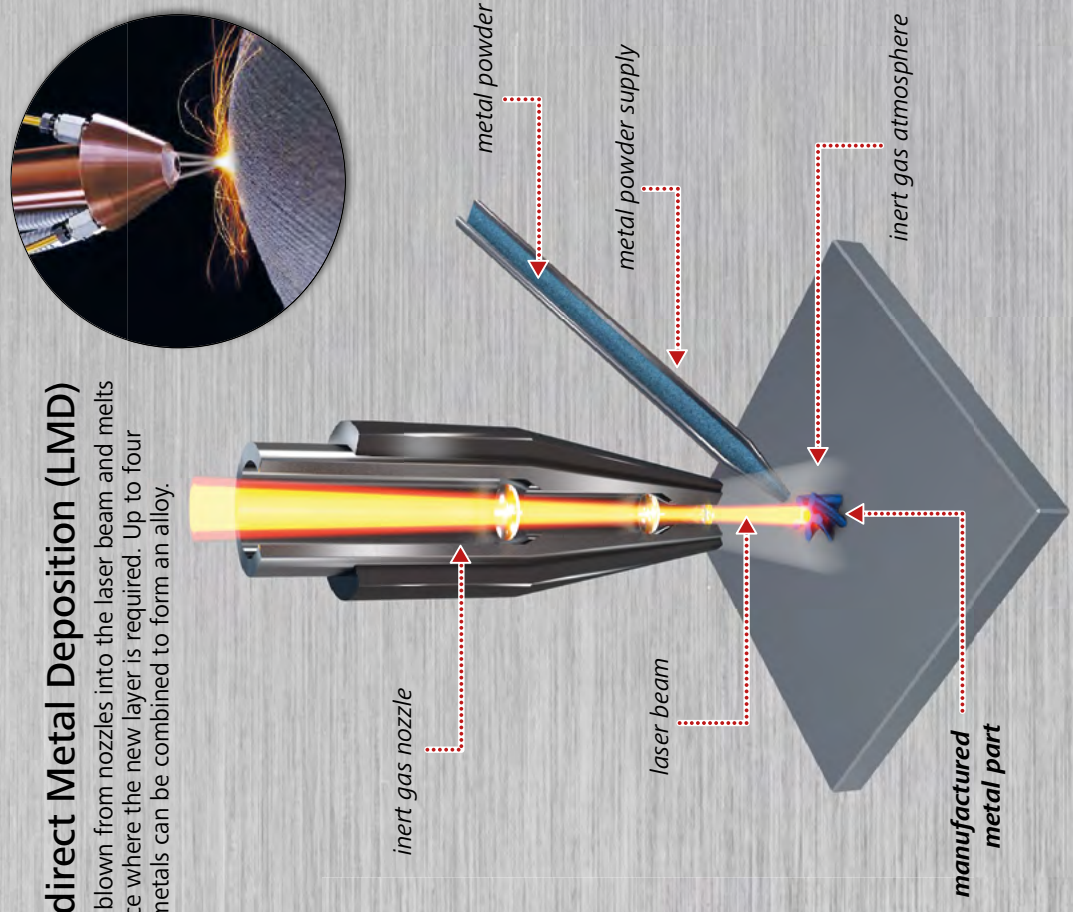
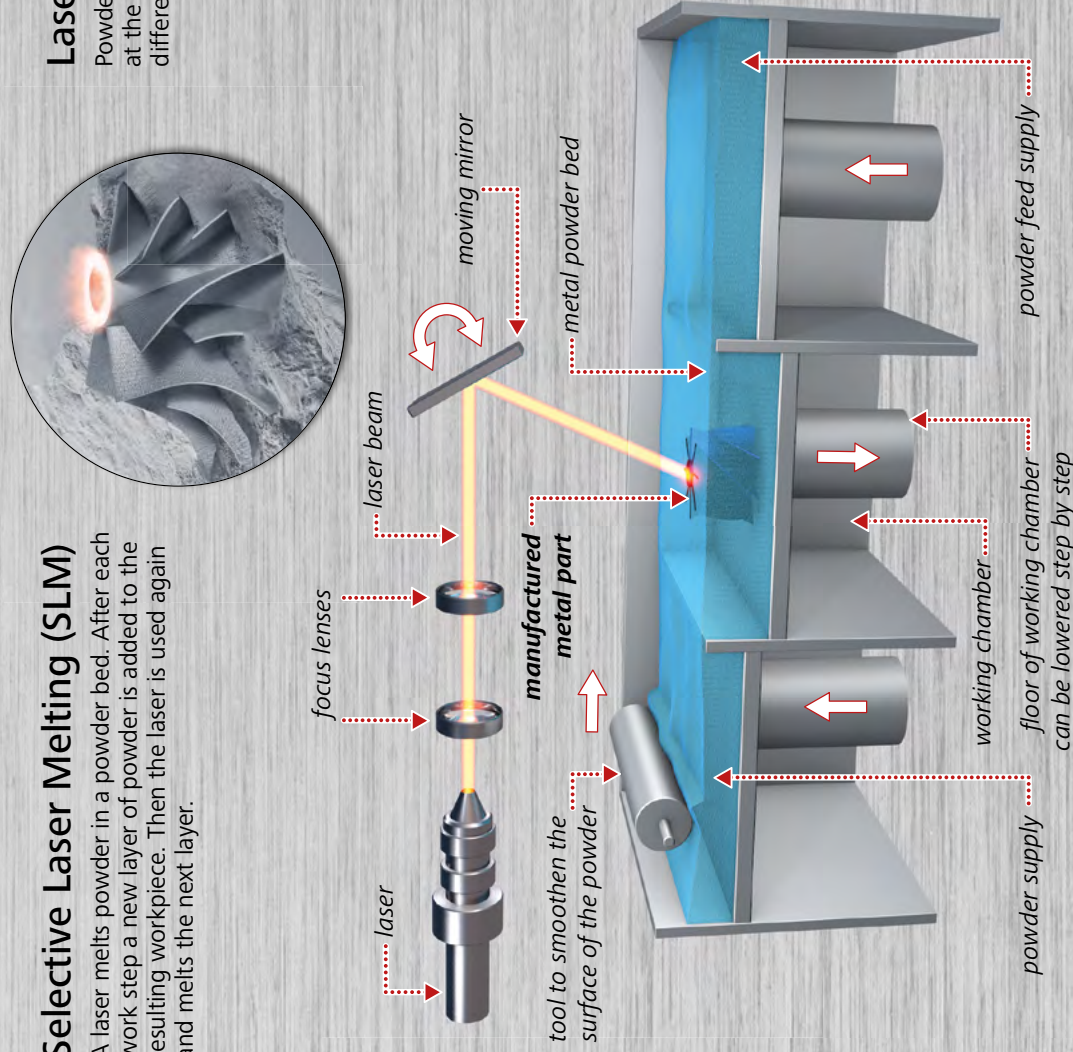


Additive Manufacturing

The first 3D printing processes were developed in the 1980s. Nowadays, 3D printing as part of rapid prototyping is an established technology used to fabricate scale models from plastic very quickly and very flexibly in areas like architecture, engineering or surgery. In future, 3D printing is to be used to produce not only models but real, functioning components with sufficient mechanical properties and adequate heat resistance – as individual pieces and on a small series scale. This is only possible with metals or ceramics. At the moment, there are two methods for forming metallic objects with the help of metal powder and laser beams.

Selective Laser Melting (SLM)

A laser melts powder in a powder bed. After each work step a new layer of powder is added to the resulting workpiece. Then the laser is used again and melts the next layer.



From Lab to Industry

In order to form a completely new industry from 3D laser printing, we need more than just special machines. Lots of things have to be reinvented. New possibilities are opening up in the fields of engineering, high-temperature technology and design as well as in the gearing of companies. Empa is involved in many of the key parts of this process.

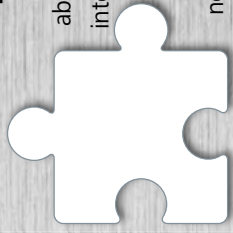
Functionalizing powder

New, pourable metal powder for SLM and LMD
(Empa)



External form of the printed component

What is the surface like? What about trueness to scale? Are there internal stresses in the component – how can they be prevented? Quality control using non-destructive testing methods.
(Empa, ETH Zurich, Inspire AG)



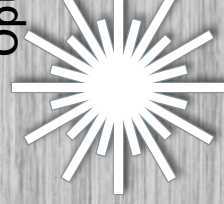
Design

Engineers can design components with a geometry that would not be possible in milling processes. New lightweight design concepts, new assembly strategies, new combinations of components become possible. (ETH Zurich, Inspire AG)



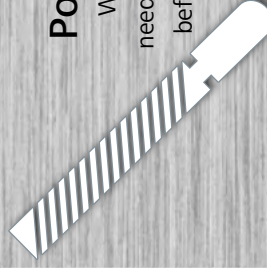
Optimized laser use

Optimized control of laser beams or electron beams allows for improved material quality and higher production speeds at the same time.
(Empa, EPF Lausanne, Inspire AG)



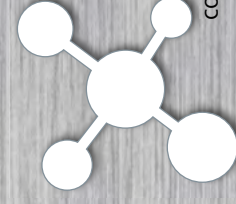
Post-processing

What post-processing is needed for the component before it can be installed?
(EPF Lausanne)



Microstructure of the printed component

What alloys are created? Can new types of alloys be formed with material gradients? New types of composite materials with a degree of hardness, toughness or temperature resistance never achieved before?
(Empa, EPF Lausanne, PSI, Inspire AG)



Recycling

Can the metal granulate from the SLM process be reused? What kind of treatment is necessary?
(Empa)



New business models for “Industry 4.0”

Business model for 3D production “on demand”. Legal solutions for product liability and certification for individual 3D pieces and small 3D series. (ETH Zurich)

