



## LASER MATERIAL DEPOSITION AS A METHOD FOR RAPID ALLOY DEVELOPMENT

### Task

Today, it normally takes many years to introduce a new alloy to the market, from the first screening to the finished component. Powerful software tools to simulate promising alloy compositions and their properties have accelerated the development process. To validate this simulation, the production of test specimens by casting, however, still consumes a great deal of time and material. Here, an additive process can significantly accelerate the screening with minimal use of materials.

### Method

Thanks to powder-based laser material deposition (LMD), a tool for rapid alloy development (RAD) is established, one that uses powder blends to rapidly make numerous alloys as solid bodies. The different alloy variants are mixed in advance from element powders or fed directly into the process via two or more powder containers. The latter also makes it possible to produce various compositions in a single test specimen by grading. The powder mixture is completely melted in the laser beam so that the alloy is formed during solidification. Within a few hours, about 20 to 30 smaller specimens (e.g. 10 x 10 x 10 mm<sup>3</sup>) of different compositions can be produced.

### Results

The process has already been successfully used to make various alloys (including high entropy alloys, Fe-Si, high manganese steels). The microstructure of the test specimens was analyzed and their properties were also evaluated, but they were also subject to, if necessary, additional process steps such as heat treatment or forming processes.

### Applications

An essential area of application is the development of process-adapted materials for additive manufacturing. So far only a few materials have been qualified for this still young production technology. Other fields of application include the screening of novel alloys (e.g. high entropy alloys) for a first property evaluation or the development of high-performance materials for turbine components (e.g. silicides).

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- 2 Test specimens of different compositions constructed with LMD.
- 3 Test specimens for compression test (partially mechanically reworked).