



Joining and Coating Technology at Fraunhofer IPK

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Adding Value to Manufacturing

# Welding of AM components

With decades of experience and know-how in welding technology, we can help you join classic manufacturing with additive manufacturing – literally.

## Technology

Tailored laser beam or electron beam welding and process chain

## Features

- Consideration of AM microstructures and necessary heat treatments
- Consideration of complex heat flow in lightweight structures



*Left: Blind seam in a conventional material  
Right: Blind seam in an additive part*

## Added value

- Implement high-quality joints
- Integrate AM components safely in overall structures
- Functionalize components by integrating small, complex AM components

# Minimizing distortion via AM simulation

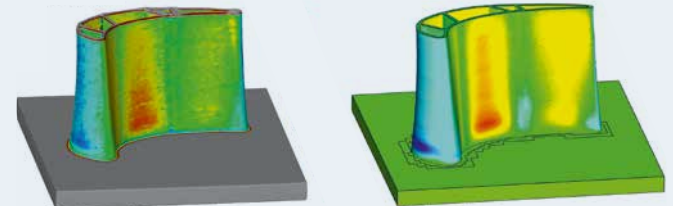
Using weld structure simulation, we can prevent errors such as distortions that can occur during the build of additive components – even before the first build job. No more trial and error!

## Technology

Non-linear, transient weld structure simulation for DED

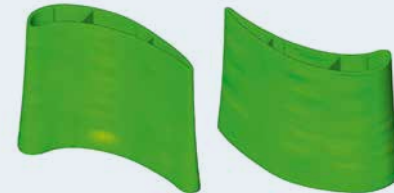
## Features

- Visualization and calculation of process variables such as temperature flow, residual stresses, and distortion
- Distortion compensation



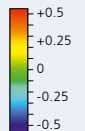
Experimental 3D scan without compensation distortion

Simulated distortion



Experimental 3D scan with compensation distortion

Normal distortion in mm



*Comparison between the experimental distortion, the corresponding simulation and the experimentally produced distortion-compensated model*

## Added value

- Reduce costs by doing it right the first time
- Adhere to tolerances and reduce rework
- Shorten development time

# Integration of electronic components

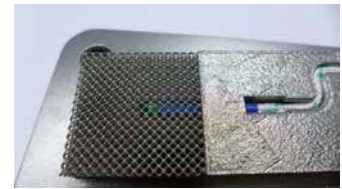
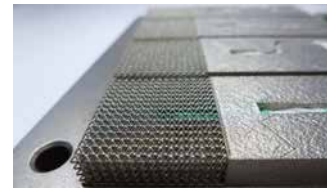
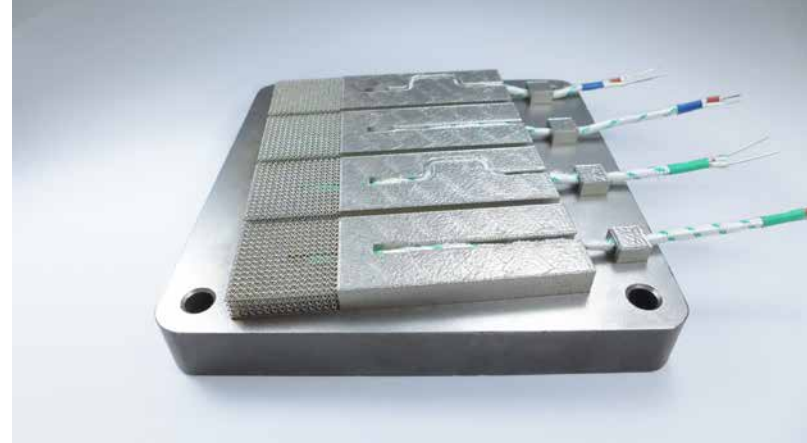
We embed electronics in additively manufactured components. With a holistic perspective of the entire process chain, we use different process combinations depending on the component.

## Technology

Embedding of electronics via process combination of L-PBF and L-DED

## Features

- Cost-efficient integration of sensor technology in complex components
- Easy embedding of electronics even in curved geometries



*Example illustrating the integration of electronic components in an L-PBF component before it is sealed by L-PBF or L-DED*

## Added value

- Gain flexibility and reduce costs
- Save up to 60 percent of process time

# Wire Electron Beam Additive Manufacturing – WEBAM

Using an electron beam in additive manufacturing leads to faster manufacturing times compared to other AM processes. Applying the principle of wire build-up welding, semi-finished products as well as large metal components can be manufactured flexibly and efficiently – from batch size 1 to series production.

## Technology

Additive manufacture of components using an electron beam and wire

## Features

- Efficient build-up of particularly reactive materials such as titanium or copper with excellent surface qualities (due to the vacuum)
- Use of refractory alloys



*Electron beam system at Fraunhofer IPK ready for Wire Electron Beam Additive Manufacturing*

## Added value

- Manufacture large components additively
- Use a wide range of materials, including metals that are difficult to weld
- Produce multi-material components with ease

# Circular AM – recycling scrap material for AM

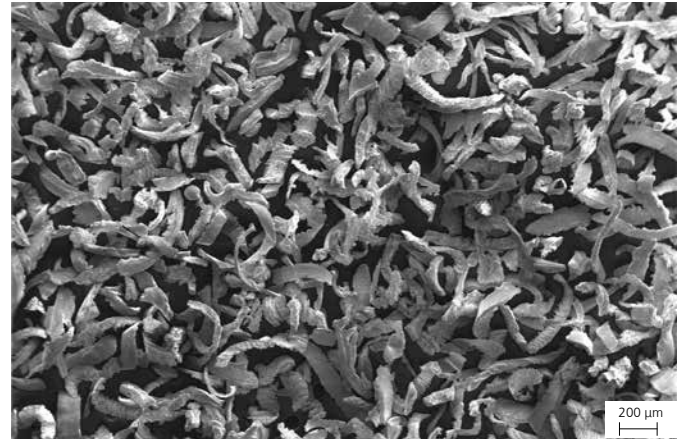
The sustainability of AM processes and components is strongly correlated to the materials used. Recycling resources such as grinding waste or reprocessing AM powders are promising approaches. Our know-how in this area focuses on the effects on processability, material quality, environment and costs.

## Technology

Recycling of residual material for L-DED and coatings

## Features

- Processing of grinding dust or chips
- Removal of contaminations
- Holistic approach by means of LCA



*SEM image of grinding dust that is processed for further use in additive manufacturing*

## Added value

- Reduce your ecological footprint and disposal costs
- Close local material cycles
- Increase resilience in procurement

**Contact us via  
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