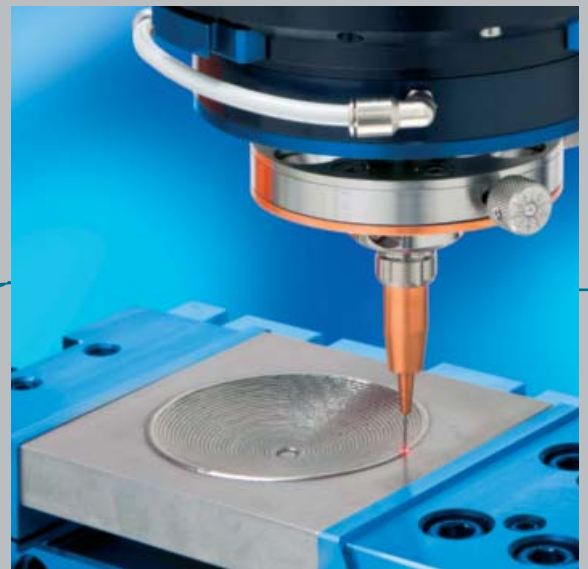
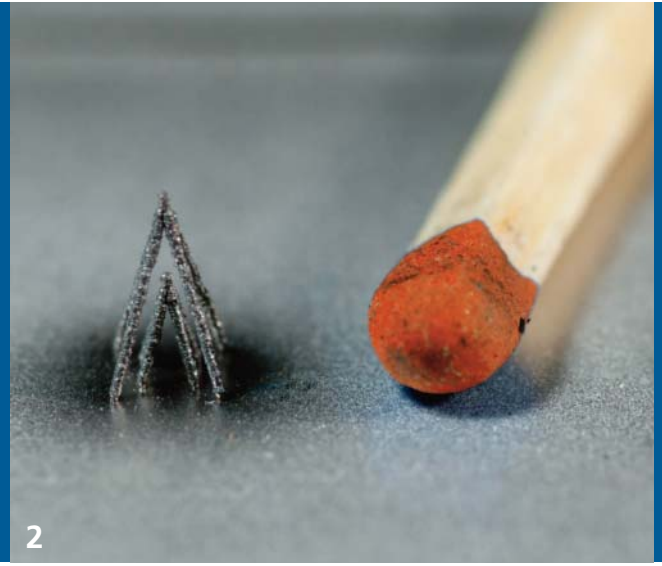
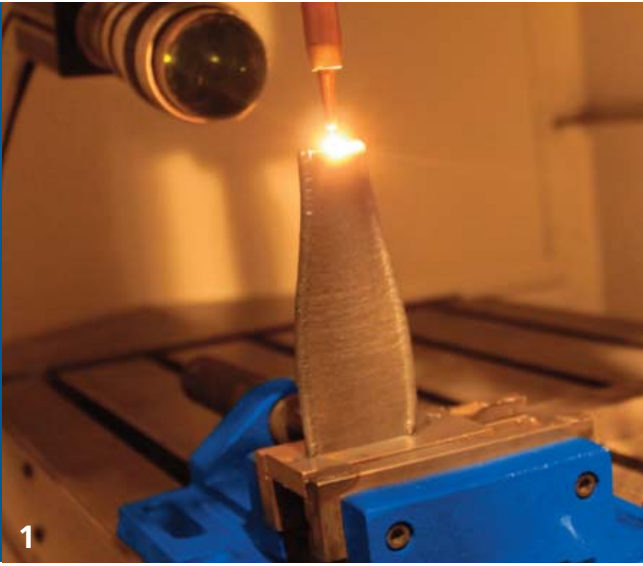


**BUSINESS UNIT  
ADDITIVE MANUFACTURING AND PRINTING**



**DRESDEN**





# INNOVATIVE PRODUCTION OF STRUCTURAL AND FUNCTIONAL COMPONENTS

The business unit Additive Manufacturing and Printing of the Fraunhofer IWS Dresden focuses on the following core fields:

- additive manufacturing technology (additive-generative procedures)
- printing technologies (generation of 2D and 3D structures on surfaces)
- image processing and data management

## Scientific basis

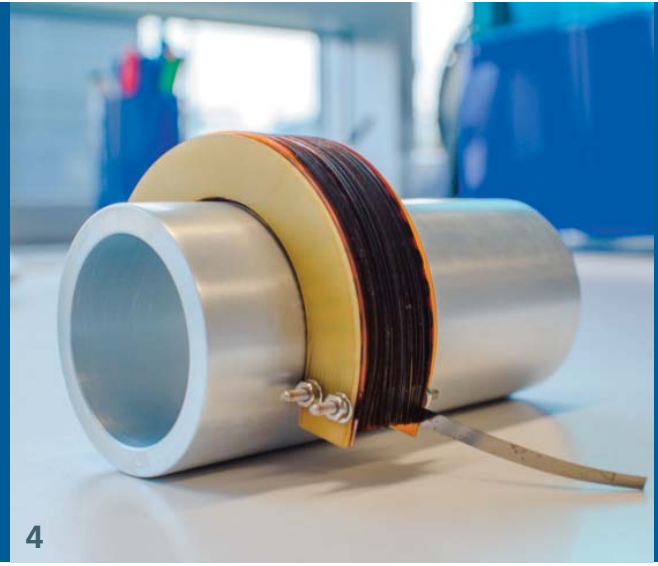
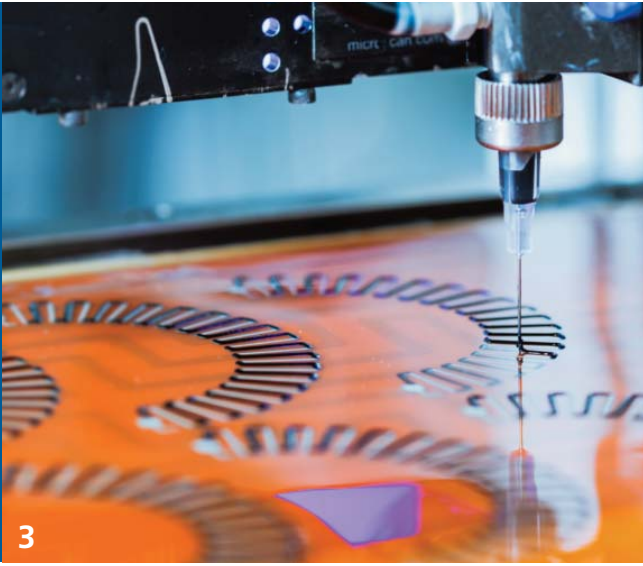
- identification of material parameters for material selection, component design and quality assurance
- testing and characterisation of additively manufactured materials and components
- development of process and component-adapted system technology
- development of application-specific printing pastes and alternative sintering technologies
- development of methods for handling large amounts of data (Big Data)

## Trends

Additive manufacturing offers enormous potential in the manufacture of geometrically complex, functionally integrated components, which consist of different material combinations. The inexpensive and industrial high quality production of these components is the goal of worldwide research efforts.

Printed thermoelectrics is one of the top priorities in the field of printing technology. The focus on thermoelectric materials in the form of pastes and inks makes it possible to use printing technologies as an industrial manufacturing process for flexible thermoelectric generators.

The real-time analysis of large data sets, their comparison with existing databases and their storage in a form that allows fast access, represents the major challenge for new research activities of the IWS in the field of "Big Data".



## OUR EXPERTISE

### Additive manufacturing

The IWS develops additive manufacturing technologies and processes with which modern metallic and non-metallic construction materials are processed into functional components and structures for flexible and efficient production of custom products. The processes are used for repairing and manufacturing new parts, while the manufactured products usually have to meet complex load profiles. Components for various application fields such as aerospace, energy technology and special machine construction are manufactured with the help of powder bed processes and direct material application of powder and wire. The unique feature consists in the cross-scale and cross-material manufacturing approach, so that users from different industries can benefit from tailor-made solutions.

### Functional printing

The IWS focuses on innovative printing technologies to apply 2D and 3D structures on surfaces with high precision and repeatability at comparatively low cost. The precise and flexible application of multi-material systems and the additive production of micro components allow creating products with radically new functionalities and property profiles. Innovative production technologies allow e.g. integrating printed electronic devices such as sensors, thermoelectric generators or energy storage devices into the components.

### Image processing and data management

Big Data refers to datasets (images or alphanumeric data), which are too large or too complex, or which change too fast to be analysed using manual and traditional methods of data processing. Classical visual image processing, relational database systems and statistical and visualisation programs are often unable to process such large amounts of data. Thus new types of platforms, data storage and machine learning methods are used for Big Data, working in parallel on hundreds or thousands of processors or servers.

- 1 *Process of additive laser wire buildup welding*
- 2 *Microstructure generated by laser powder buildup welding*
- 3 *Dispenser printing of structures made of PEDOT:PSS and silver*
- 4 *Contour adjusted thermoelectric module on a piece of pipe*



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## HIGHLIGHTS

As part of the BMBF (Federal Ministry of Education and Research) program "Zwanzig20 - Partnership for Innovation", the joint project "**Additive Manufacturing**" (in short: **AGENT-3D**) was launched in 2013. The consortium headed by the Fraunhofer IWS consists of more than 100 partners, including a majority SMEs and large enterprises, receiving funding of up to 45 million Euros from the BMBF for the period 2013 - 2020. The long term goal of the project is to make an important contribution to the development of Germany as a leading supplier of additive production, thereby strengthening the international competitiveness of German companies.

AGENT-3D considers, besides the necessary technology and process developments, also socio-economic aspects of additive-generative manufacturing. These include, among others, B2B and B2C business models, social and socio-political implications, including legal issues. AGENT-3D creates synergies through interdisciplinary expertise networking. Under the motto "Printing New Worlds", the IWS leads a unique network of companies and investigation facilities with the goal of profiting from the so far unexploited potentials of additive manufacturing in the industrial environment.

The use of **printing technologies** for cost-effective and large-scale production of flexible thermoelectric generators (TEG) is a field of application with an enormous potential. The IWS has been able to create a complete thermoelectric generator on a flexible carrier film using dispenser printing. Even at low temperature differences, the generator can produce an electrical voltage which is sufficient to supply devices such as sensors with electrical energy. These, in turn, can be applied to different components of production systems, forming the basis of a sensor network that ensures better communication between the individual machine components. An important contribution to Industry 4.0.