

3D Printed electronics

Printing in and on complex shaped parts



Jet-Dispensing of a heating structure using a 6 axis robot

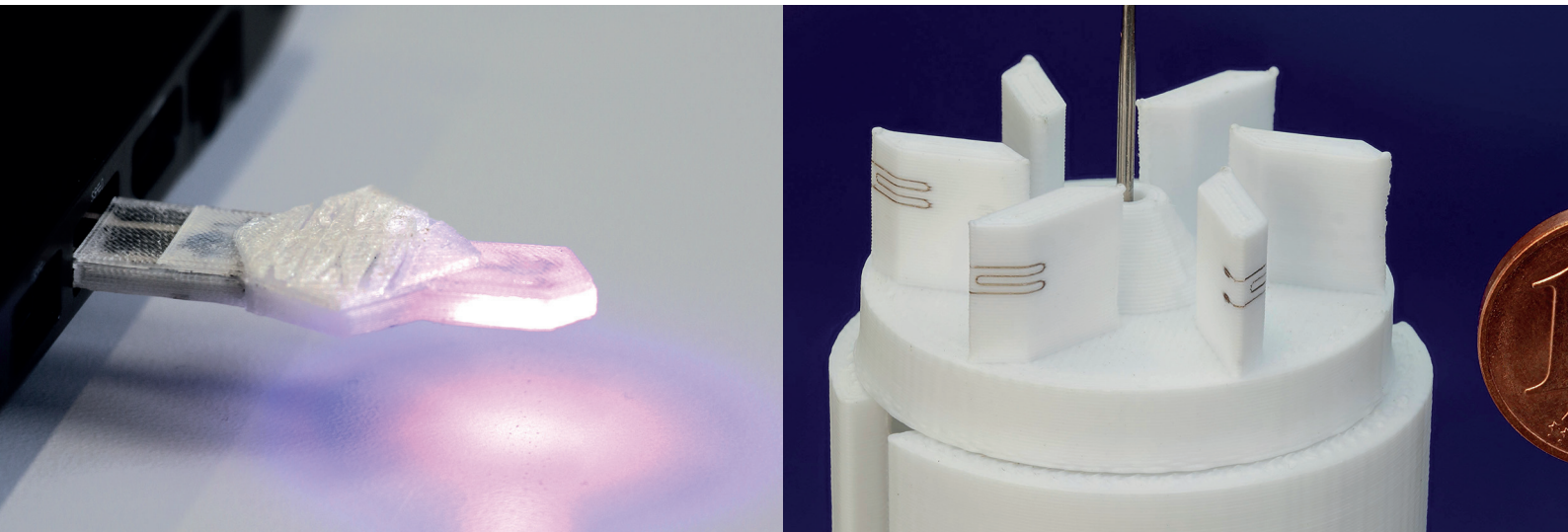
Using multiple axis printing systems like robots enables direct printing of sensors and heaters on top of complex shaped parts. Combining the widespread process of »3D printing« (also referred to as Fused Deposition Modeling or FDM) with printed electronics makes an integration of printed tracks, sensors inside the part possible. This opens up new compact ways of integration and high functional density.

More flexibility through more axes

The use of industrial robots and 5-axis gantry systems makes it possible to print functions such as sensors, wiring or heaters on components with complex surfaces exactly where they are needed. Various printing technologies such as Aerosol Jet® or dispensing can be used to print structure sizes ranging from a few micrometers to several meters. Three different systems are used at Fraunhofer IFAM for the functionalization of complex: A Kuka KR16 robot, a Universal Robots UR5e and a 5-axis gantry system from Neotech AMT. Different printing, pre- and post-processing methods can also be used on these systems.

Environmentally friendly due to Functional Printing

The functionalization of components and surfaces by functional printing offers significant advantages over other technologies. First of all, material is only applied where it is necessary during the printing process. This eliminates the expensive post-treatment processes in which environmentally harmful chemicals are used. Furthermore, the digital approach enables the production of a wide range of product variants, including individualised unique products, on the same system.



Functionalized 3D Printing

Printing technical plastics and an electrically conductive material in parallel opens up new levels of freedom in design. Components such as circuit paths can be printed on the inside of a component. Strain or temperature sensors can also be printed onto the surface of an FDM component using dispensing or Aerosol Jet® printing. The temperature sensitive FDM material requires the use of special curing processes for hardening the printed sensors. Laser or photonic sintering are possible options here.

The key advantages

These technologies provide a variety of advantages:

- High freedom of design
- Compact construction and high integration density
- Precise / automated sensor application
- Electronic functions in a 3D printed part
- Product individualization through digital manufacturing processes
- Electrical wiring without cable or PCB
- High degree of automation using robust production systems

Our offer

Fraunhofer IFAM offers you the following R&D services in this field:

- 3D Electronics and Functionalized 3D Printing consulting services
- Feasibility studies for 3D Electronics and Functionalized 3D Printing. Including:
 - Mechanical and electrical design
 - Material selection
 - Production of prototypes
 - Testing of prototypes
- Process integration, profitability studies and know-how transfer

Left: 3D printed USB Drive including SMD parts and printed interconnects (Hyb-man project)
Right: Strain gauges printed on 3D surface

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM

Wiener Strasse 12
28359 Bremen, Germany

Contact

Smart Systems
Jonas Deitschun
Phone +49 421 2246-239
jonas.deitschun@ifam.fraunhofer.de

Jan Conen
Phone +49 421 2246-237
jan.conen@ifam.fraunhofer.de