

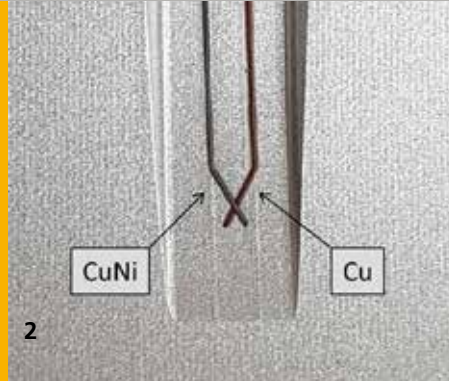


# Fraunhofer IFAM

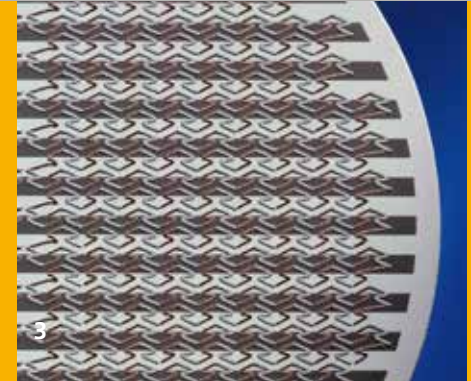
FRAUNHOFER INSTITUTE FOR MANUFACTURING TECHNOLOGY AND ADVANCED MATERIALS IFAM



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- 1 Screen printing machine for printing onto components and flat samples.
- 2 Aerosol Jet® printed thermocouple of type T (Cu-CuNi).
- 3 Printed thermocouple network for increased measurement accuracy (in cooperation with Ecomatik).

## PRINTED THERMOCOUPLES

**Fraunhofer Institute for  
Manufacturing Technology and  
Advanced Materials IFAM**  
- Shaping and Functional Materials -  
Wiener Strasse 12  
28359 Bremen | Germany

Institute Director  
Prof. Dr.-Ing. Matthias Busse

Contact  
Mario Kohl  
Phone +49 421 2246-174  
mario.kohl@ifam.fraunhofer.de

Dr. Volker Zöllmer  
Phone +49 421 2246-114  
volker.zoellmer@ifam.fraunhofer.de

[www.ifam.fraunhofer.de/en/printing](http://www.ifam.fraunhofer.de/en/printing)  
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Temperature monitoring is an important aspect of many industrial applications. At Fraunhofer IFAM all common types of thermocouple pairs (e. g. type T: Cu-CuNi or type K: NiCr-Ni) can be applied to components or substrates using functional printing methods. The achievable level of accuracy is within the tolerance range specified in EN 60584.

### Advantages

The specialists at Fraunhofer IFAM formulate and apply printable electrically conductive thermocouple inks and pastes using printing processes. The thermocouple structures are applied to flat substrates, foils or components using dispensing or inkjet processes as well as screen and pad printing. The main advantages of this approach are:

- Individual layout of the thermocouple structures (redundant structures, sensor networks)
- Structure widths of less than 100 µm are possible

- Direct contact between thermocouple structures and the substrate surface for optimal thermal coupling (monitoring of components, battery cell monitoring)
- Integration into the manufacturing process of the component, avoiding the need for manual steps and possible replacement of cables and plug connectors with printed feed circuits

### Portfolio

Fraunhofer IFAM offers the following R&D services, from the consultation stage through feasibility studies to pilot manufacturing and knowledge transfer:

- Selection of printable materials and use of suitable printing technologies, as well as adapted pre-treatment and post-treatment processes
- Determining of the thermoelectric performance of the thermocouples
- Characterization of reliability and long-term behavior