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FRAUNHOFER INSTITUTE FOR MANUFACTURING TECHNOLOGY AND ADVANCED MATERIALS IFAM


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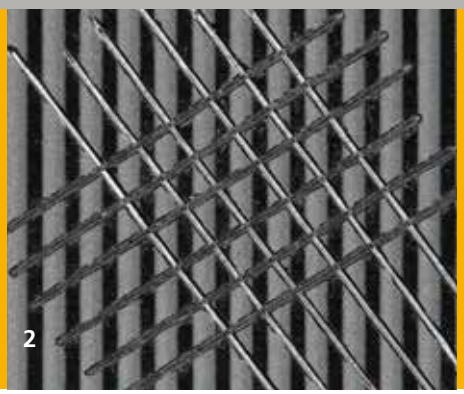
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1 *Determination of the tensile strength of a cable contact on a printed heating structure.*

2 *Characterization of the adhesion strength of dispensed heating conductors using a cross-cut-test.*

3 *Dispensing a heating structure onto a cylinder surface.*

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PRINTED HEATING STRUCTURES

Locally optimized temperature control, ice removal, or heating of components and surfaces play a critical role in many applications, such as in the aerospace, automotive, and medical technology fields. Resistive heating elements or film heaters can often be difficult to integrate into a component or onto a 3D surface, requiring additional manual-process steps.

Advantages

Printed heating structures are formulated at Fraunhofer IFAM from printable electrically conductive functional materials and applied using printing processes. The heating structures can be applied as inks using inkjet or aerosol jet technology, or as pastes, using dispensing methods and screen and pad printing on flat substrates such as films or on parts. The main advantages of this approach are:

- Individual layout and production of heating structures (suitable for individual or mass production, depending on the printing process)
- Optimal placement of heating structures on or in the component
- Direct contact between the heating structure and the 3D surface of the component, for optimal heat transfer (without glue layers or air bubbles)
- Integration in the manufacturing process of the part, avoiding the need for manual steps, while simultaneously replacing cables and plug connectors with printed feed lines

Portfolio

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

- Selection of printable materials and use of suitable printer technologies and adapted pre-treatment and post-treatment processes
- Determination of power output and heating behavior of the materials using thermography
- Characterization of the reliability and long-term behavior of the materials