

1 *Thinned IC sandwiched between two wiring foils*

2 *Large area foil component mounted on a wiring foil*

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3D FOIL ASSEMBLY TECHNOLOGY SERVICES

Scope of application

Printed and flexible electronics enable new functionalities and features for several application areas, e.g. in the fields of:

- electronics
- displays and lighting
- consumer packaged goods
- healthcare and sports
- textiles
- advertising and media
- gaming and toys

Novel functionalities enabling new product features in these application areas include flexible solar cell modules, displays and batteries as well as OLEDs, printed RFID and large area sensors on plastic films, just to mention a few. Integration of these flexible components into a complete system with flexible wiring layers requires particular knowledge and experience in 3D foil assembly and foil-to-foil interconnection technolo-

gies as well as special tools and equipment. The Fraunhofer Research Institution for Microsystems and Solid State Technologies EMFT service offering for "3D Foil Assembly Technology" enables integration of flexible components on foils, foil-to-foil stacking and development of flexible foil systems. It is designed to help our customers to implement their flexible systems and tackle the challenges in this area.

Offered service

Foil components and/or wiring foils often have to be assembled and interconnected on a foil backplane to build a flex "system in foil". Fraunhofer EMFT offers system development and 3D assembly and interconnection services for integrating different functionalities such as energy supply and storage, sensorics, communication interface into a flexible „system in foil“.

Fraunhofer EMFT is participant in the





The assembly services offered by Fraunhofer EMFT include:

- laser dicing of coated foil devices
- laser drilling of via holes
- coating with a laminating adhesive
- handling techniques of foil components
- solder-free foil-to-foil interconnection e.g. by screen printing, needle or jet dispensing
- aligned, void-free lamination (stacking) of two or more single- or doublesided wiring foils and/or foil components (e.g. flexible displays or foil sensors)

Some typical examples of implementation:

- assembly of two single-sided flexible wired foils
- connection of a wiring foil with a specific topography on a flexible printed circuit board or a wiring foil backplane
- connection of a flexible foil component on a flexible printed circuit board/wiring foil

Benefits for the customers

Foil-to-foil lamination opens access to innovative 3D system architecture, enabling high integration density, and the creation of miniaturized and thin systems. The mechanical flexibility brings a new dimension into microelectronic products, facilitating installation on curved or irregular shapes and surfaces. Despite their thinness, flexible foil systems offer high reliability when exposed to dynamic bending stress. The open lab environment for 3D foil assembly at Fraunhofer EMFT offers the customers

the opportunity for easy and cost effective testing of new concepts and processes for this next generation of flexible electronics.

Technology

For the mechanical interconnection of wiring foils and foil components the Fraunhofer development team uses the Fraunhofer EMFT "Pick & Laminate" technology, allowing void-free multilayer foil stacking. They guarantee alignment accuracies of less than 100 μm displacement in x- and y-direction for each layer. The typical thickness of a foil system including two single foil layers and a sandwiched coated adhesive is < 150 μm . The technique is applicable for all optically transparent foil materials (e.g. PET, PEN, PI). Electrical interconnections from top foil to bottom foil are implemented using a solderfree via fill process with electrical conductive paste materials. The typical resistance value is less

than 1 Ω/via . The overall thermal budget for the assembly and interconnection processes is compatible with PET foil material.

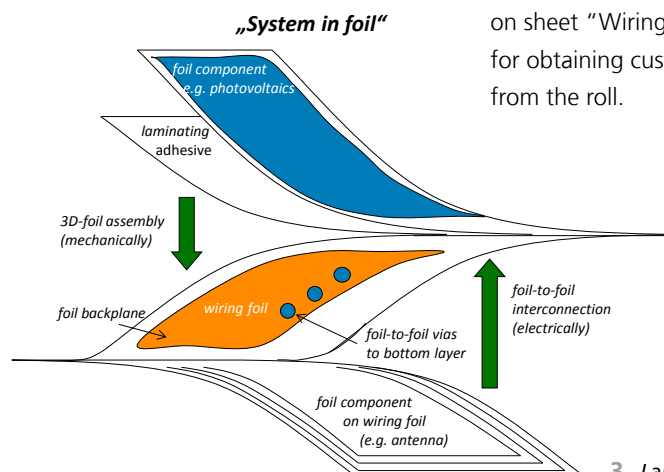
Quality control

To ensure high quality samples, Fraunhofer scientists carry out optical inspection and electrical parameter and reliability testing (resistance, humidity, temperature, bending stress). Determination of the peel strength of a flexible foil laminate (T-peel test) can be offered as well.

Terms and conditions

Fraunhofer Research Institution for Microsystems and Solid State Technologies EMFT offers this service for R&D projects and prototype fabrication. To facilitate access to 3D foil assembly the development team can support customers in conception, design and implementation.

Please see also Fraunhofer EMFTs information sheet "Wiring systems on plastic films" for obtaining customer-designed wiring foils from the roll.



3 Large area foil component mounted on a wiring foil

4 In-line optical inspection tool