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Fraunhofer ITWM Develops Optical Measurement Systems for the Sub-2 μm Range

The Next Generation of OCT Layer Thickness Measurement Systems

Imaging techniques are known mainly from medicine: high-resolution optical coherence tomography (OCT) is used in ophthalmology, for example. The Fraunhofer Institute for Industrial Mathematics ITWM uses this technique to measure the thickness of very thin layers and is developing the next generation of these measurement systems in the »Dünnschicht-OCT« project. In this project, the researchers, together with Mabri.Vision GmbH, are advancing into layer thickness ranges of less than 2 μm . The German Federal Ministry for Economic Affairs and Climate Action is funding the project in its »Zentrales Innovationsprogramm Mittelstand« (ZIM).

A very close look is taken here: Optical coherence tomography systems are used for high-resolution layer thickness measurement of single and multilayer samples. The range of applications is also diverse outside of medicine: this includes transparent paint layers, packaging and films, coated wafers, glass substrates, thin wires and the layer structure of tubes and hoses.

Move Resolution Limit

Researchers from the ITWM department »Materials Characterization and Testing« are drawing on their many years of expertise with measurement systems in »Dünnschicht-OCT« to improve the resolution limit of OCT systems from the current level of about 10 μm to below 2 μm . »We want to achieve this step by taking a holistic view of the hardware – such as broadband light sources and detectors – and the software in the area of data processing and data evaluation,« says Dr. Stefan Duran, project manager at Fraunhofer ITWM, about the ZIM project. The competences of Mabri.Vision also come into play: The Aachen-based machine and plant manufacturer supplies the hardware – the OCT systems – while Fraunhofer ITWM focuses on material characterization and software.

Determine Layer Thicknesses Quickly by OCT Measurement

Optical coherence tomography generates images with micrometer resolution. The light used in the process, in the visible or near-infrared wavelength range, penetrates a

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transparent sample, is partially reflected at the boundary layers, and then detected. Analysis of the interference pattern of the detected signal then allows layer thicknesses to be calculated very quickly: thanks to measurement rates of up to 150 line measurements per second, the measurement technology can be used in many inline and offline applications. With this new generation of OCT measurement systems, application fields such as the inline measurement of very thin multilayer films could be addressed more effectively in the future.

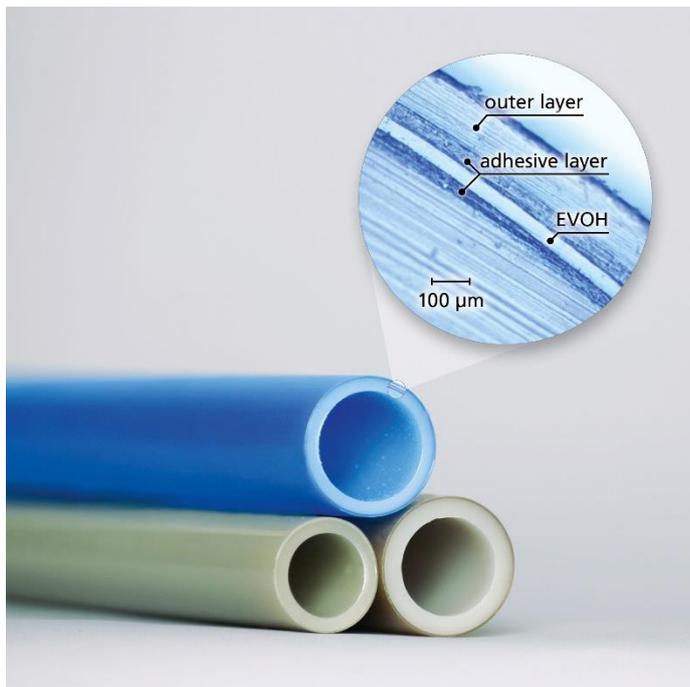
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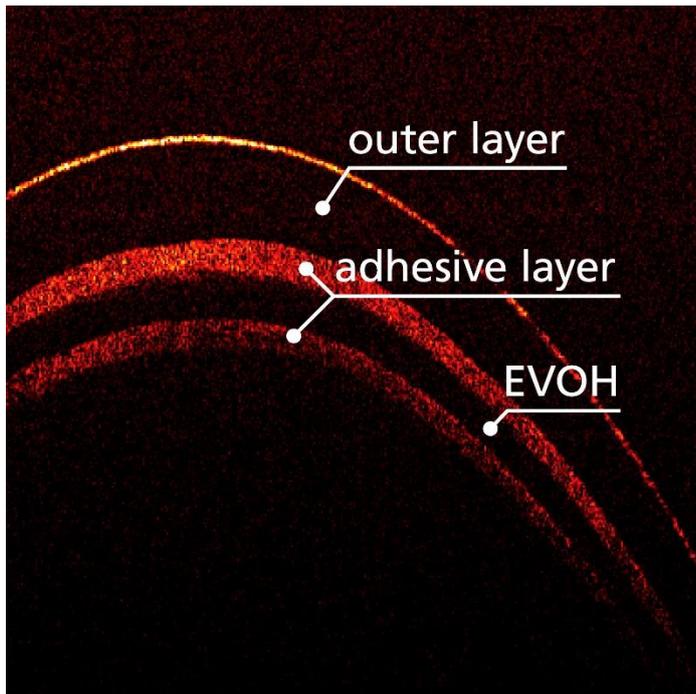
Customized Funding

The project is part of the ZIM funding program of the German Federal Ministry for Economic Affairs and Climate Action. The program supports innovative projects to thereby develop potential for value creation and raise the level of application-oriented knowledge. »Dünnschicht-OCT« has a term of three years.

Bildmaterial



A multilayer plastic pipe consisting of outer and inner layers with an EVOH layer bonded via adhesion promoters in between. © Fraunhofer ITWM



Labeled microscope image of a plastic tube. © Fraunhofer ITWM

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About the Fraunhofer Institute for Industrial Mathematics ITWM

The Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern is one of the largest research institutes for industrial mathematics worldwide. We see our task in further developing mathematics as a key technology and providing innovative impetus. Our focus is on the implementation of mathematical methods and technology in application projects and their further development in research projects. The close cooperation with partners from industry guarantees the high practical relevance of our work.

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Their integral components are consulting, implementation and support in the application of high-performance computer technology and the provision of tailor-made software solutions. Our various competencies address a wide range of customers: automotive industry, mechanical engineering, textile industry, energy and finance. This also benefits from our good networking, for example in the High performance center "Simulation- and software-based innovation".

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