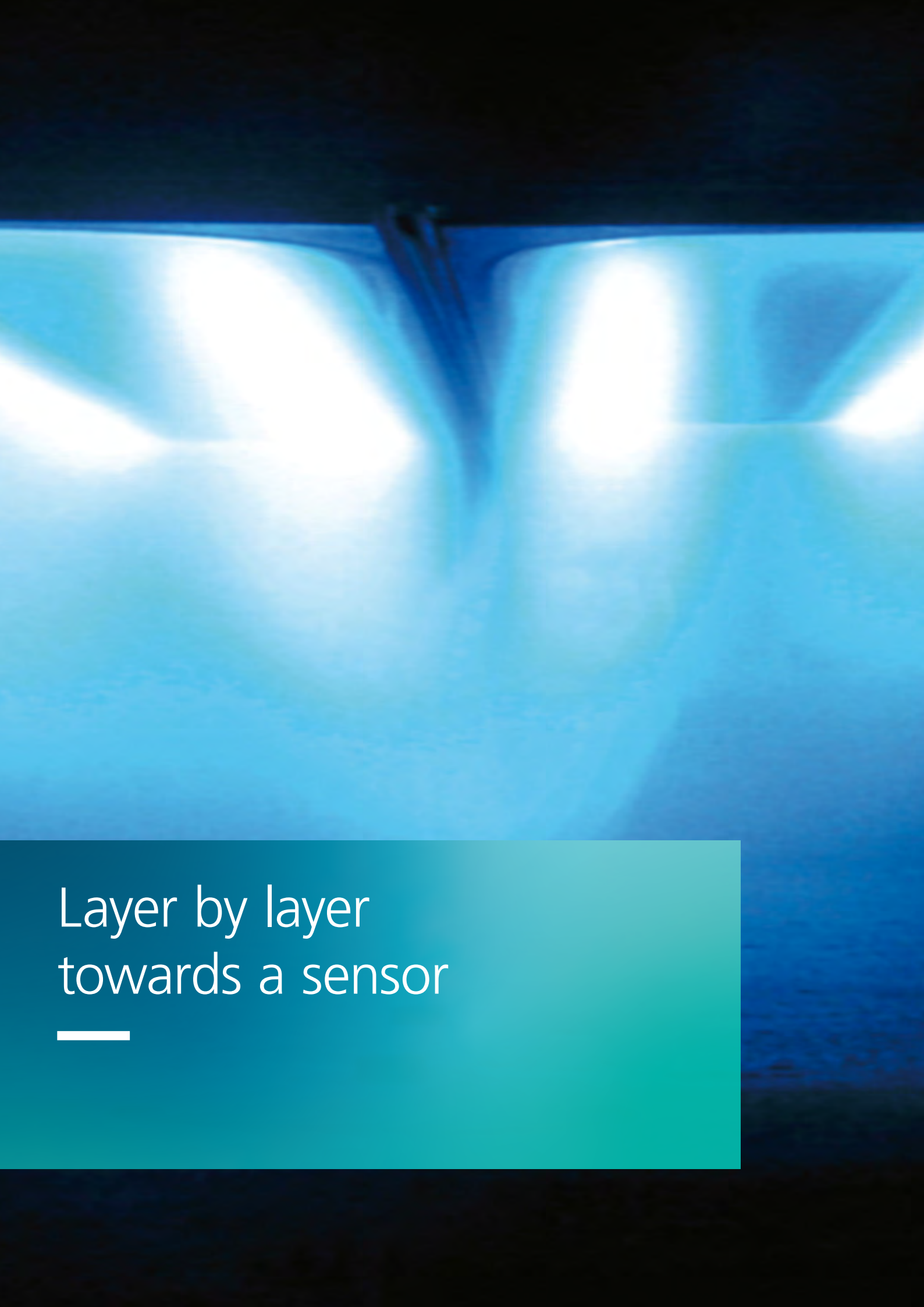


Sensors

Applications – Technologies – Components

The background of the slide features an abstract, artistic composition of light. At the top, there are two bright, glowing white light sources that create a strong lens flare effect, radiating outwards in a fan-like pattern. The light transitions from white to a vibrant cyan and then to a deep, dark blue as it moves towards the bottom. The overall effect is ethereal and futuristic, suggesting a high-tech or scientific theme.

Layer by layer
towards a sensor



Sensor technology is considered a key technology for measuring, controlling, regulating, and monitoring of a wide variety of conditions and in many different environments.

Sensors are used in all areas of life, for example, in mobile devices such as in mobile devices such as cameras or for condition monitoring in museums or sensitive production environments.

The number of deployed sensor solutions is multiplying rapidly. Miniaturization and low-cost mass production play a major role here. In industry, on the other hand, ever more sophisticated sensor systems are being developed, e.g. for automation, the automotive sector or in medical technology. High levels of accuracy, reliability and precise integration are required in this field, depending on the environment.

The Fraunhofer FEP has a broad and long-standing know-how in vacuum coating, the development of process technologies and precision. The core competencies of the institute provide innovative technological approaches for novel sensor solutions.

In particular, the use of electron beam technology for surface modification, and also the use of magnetron sputtering technologies for precision coatings enable extremely precise coating of sensitive material combinations and the development of miniaturized sensor devices and systems.



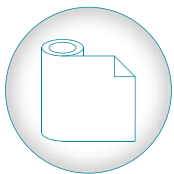
We develop your customized, application-specific sensor solution!«

Overview

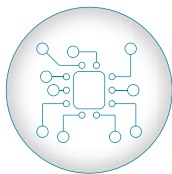
In the following you will find an overview of the range of applications in which our sensor technologies can be used. Many of the technologies can also be adapted to your specific requirements.

Please do not hesitate to contact us. We will be happy to discuss the possibilities of available sensor solutions and ways to develop new technologies with you.

Fields of application:



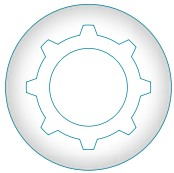
Packaging



Electronics



Preservation



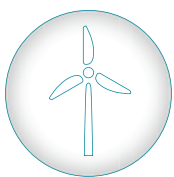
Mechanical Engineering



Life Sciences

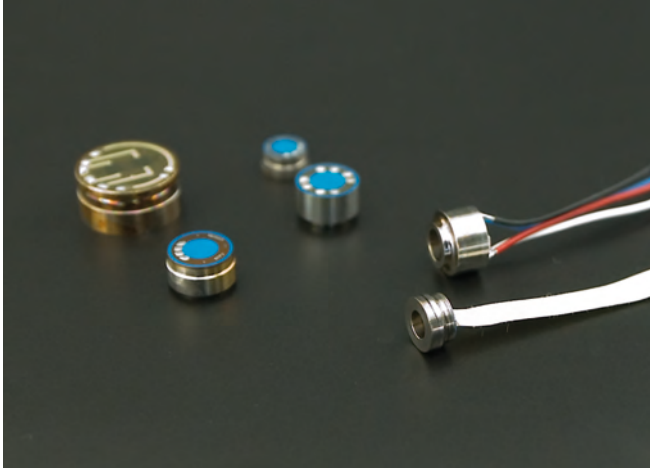


Mobility



Environment and Energy

Insulation layers and barrier layers



High temperature pressure sensors

- Deposition of low defect insulation layers by reactive magnetron sputtering for pressure sensors
- Insulation layers with minimal proton diffusion and very good insulation strength, dielectric strength up to 2000 V for metal thin-film sensors
- Stable even at very high temperatures
- High deposition rate of approx. 2 – 3 nm/s
- Barrier layers against hydrogen diffusion

Integration level

- Layers

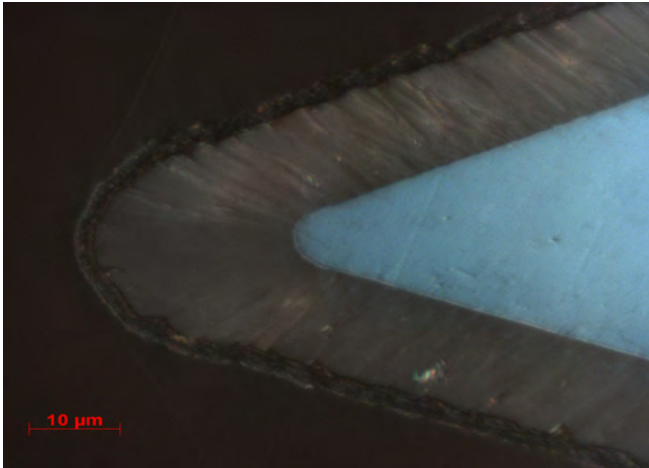
Media

- Gases, Liquids (also hydrogen)
- Surfaces

Fields of application:



Thin layers for component-integrated sensor technology



Component-integrated condition monitoring and force, deformation and torque sensors

- Sensor and insulation layers for directly integrated strain gauges
- Directly applied piezoelectric AlN- and $\text{Al}_x\text{Sc}_{1-x}\text{N}$ -layers for
 - acoustic and sensing elements
 - force measurement close to the point of action
- Stable even at very high temperatures
- Applicable in tooling machines

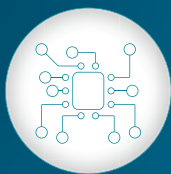
Integration level

- Layers

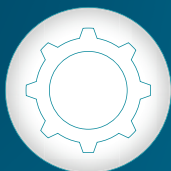
Media

- Surfaces (devices)

Fields of application:

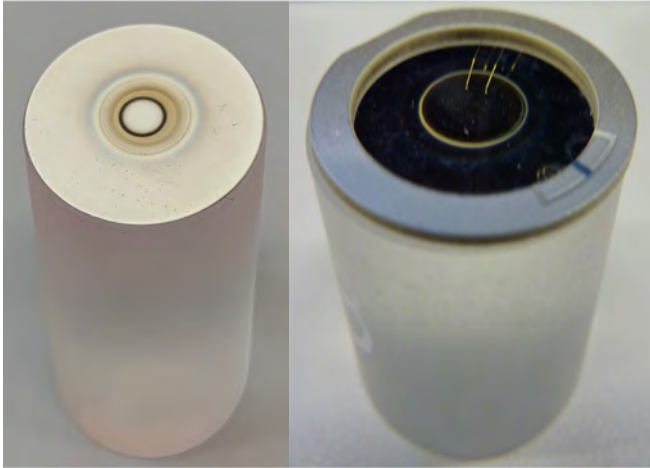


Electronics



Mechanical Engineering

Piezoelectric thin films for ultrasonic applications



- Technology for deposition of AlN and $\text{Al}_{1-x}\text{Sc}_x\text{N}$ layers by reactive magnetron sputtering
- Thin film transducer for
 - high resolution ultrasonic microscopy
 - flow rate measurement
 - non-destructive condition monitoring

Integration level

- Layers

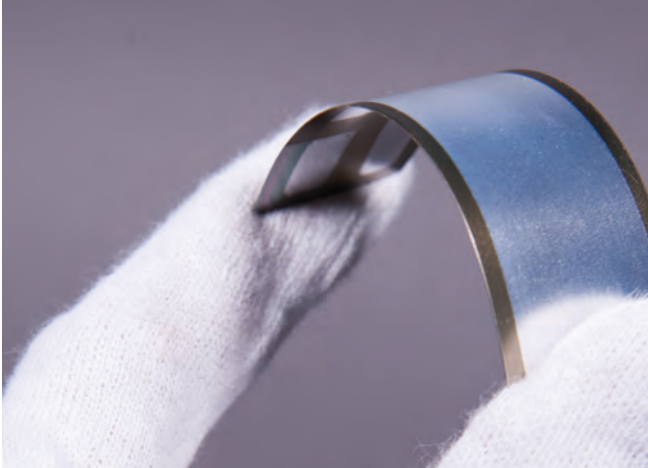
Media

- Surfaces (devices)
- Gases
- Liquids

Fields of application:



Micro-energy harvesting for energy self-sufficient sensor technology



- Electromechanical simulation of the load condition
- Technology for deposition of AlN and $\text{Al}_x\text{Sc}_{1-x}\text{N}$ layers by reactive magnetron sputtering
- Deposition of thin, homogeneous piezo layers for the piezo-based energy generation from mechanical energy (deformation, vibration)
- Self-sufficient on-site power generation for sensor applications

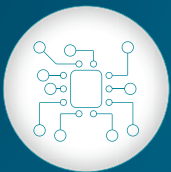
Integration level

- Simulations
- Layers

Media

- Surfaces

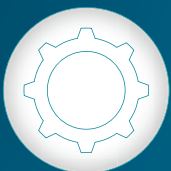
Fields of application:



Electronics



Life Sciences



Mechanical Engineering



Mobility

Thin-film corrosion sensors for monitoring sensitive objects



- Real-time corrosion sensor to monitor ambient air for corrosive gases
- Deposition technologies for reproducible, precise deposition of thin metal layers
- Sensor consisting of thin metal layer (Cu, Ag, Pb, Fe or bronze) applied to an insulating ceramic carrier plate

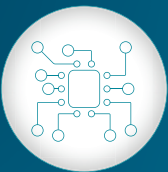
Integration level

- Component

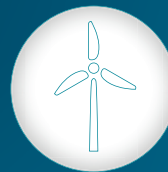
Media

- Surfaces

Fields of application:



Electronics



Environment and Energy



Preservation



Packaging



Mobility

Sensor systems for engine diagnostics



- High temperature pressure measurement directly in the combustion chamber
- Pressure sensors
- Torsion sensors

Integration level

- Layers

Media

- Gases
- Solids

Fields of application:



Mobility

Thin film systems for radar sensors



- Transparent, functional coatings for headlight assemblies
- Radar beams can be shaped and directed in a targeted manner
- Coating can manipulate beam spread differently depending on application
- Coating does not affect the color of the light source
- Withstands temperature fluctuations between -30°C – $+120^{\circ}\text{C}$

Integration level

- Layers

Media

- Surfaces

Fields of application:



Technology

Thin films

We qualify plasma processes and electron beam technologies for industrial application and production. In particular, we develop sputtering, evaporation and PECVD processes to apply optical, electrical, acoustically or magnetically effective coatings and coating systems with high quality and low number of defects at high coating rates.

In addition, our portfolio includes various types of coating and surface functions. These include mechanical protective coatings for magnetic heads and sensors as well as electrical insulator, barrier and other coatings for sensors (e. g. gas sensors)



Electron Beam Technologies



Roll-to-roll Technology



Plasma-assisted Large-area and Precision Coating

Electron beam welding

With our know-how in electron beam technology, we offer the possibility to develop and carry out welding processes with electron beams. A focused electron beam causes the material to melt at the joint of the workpiece. The local overheating of the molten pool due to the high power density of the electron beam creates a vapor capillary and thus the possibility to melt the joint very locally down to great depths. With gap-free positioning of the joint, welds with very large aspect ratios are thus possible without filler metal. A low heat input compared to the weld seam dimension allows low-distortion welds for highly stressed and sensitive components and can be used in particular for the development of sensor components.

Services

- Barrier measurements
- Insulation strength measurement of thin films
- Laboratory services
- Laboratory analytics
- Feasibility and market studies
- Simulations
- Process development
- Device and system development
- Prototypes and demonstrators
- Characterization and testing
- Pilot production
- Process transfer, licensing



Contact

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