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The HITACT project is developing thermal imaging sensors with significantly improved temperature resolution

New Generation of Highly Sensitive Infrared Sensors Opens Up Opportunities for Medicine, Mobility, and Industrial Imaging

The Fraunhofer Institute for Photonic Microsystems (IPMS), in collaboration with Heimann Sensor and the Leibniz Institute for Solid State and Materials Research Dresden (IFW Dresden), is developing the technological foundation for a new generation of thermoelectric infrared sensor arrays. By integrating highly efficient thermoelectric materials into CMOS-compatible manufacturing technology for the first time, the project aims to create significantly more powerful sensors. The goal is to achieve a temperature resolution of less than 20 millikelvin with pixel sizes of less than 45 micrometers, which is an important step toward new applications in medicine, industry, mobility and security.

Thermoelectric infrared sensors enable noncontact temperature measurement and the generation of thermal images. They are already in use today in process monitoring, building automation, and security technology. However, the performance of current systems is limited by the thermocouple materials used. The new project addresses this challenge by employing significantly more efficient thermoelectric materials and a novel MEMS device concept.

New Applications Thanks to Higher Sensitivity

The goal of improving temperature resolution opens up numerous new areas of application. In the medical field, future applications could be developed to support early cancer detection or the detection of externally visible inflammation. In the context of senior living, the sensors also enable new solutions, such as the reliable detection of falls or emergency situations in the home.

Furthermore, autonomous vehicles benefit from the higher sensitivity of the sensor arrays. For industrial applications, new possibilities are opening up in thermography and process monitoring. In addition, the use of these sensors in cost-effective solutions for contactless temperature measurement opens the door to further application and market segments.

Fraunhofer IPMS Develops MEMS Technology for the Integration of Novel Materials

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Fraunhofer IPMS is taking on key roles in the project's development of MEMS technology. This includes the integration of novel thermocouple layers, the development and optimization of the necessary manufacturing processes, and the production of demonstrator chips. In addition, strategies are being developed to integrate the new materials into the institute's 200-mm production line in the future.

The project partners will initially demonstrate the developed technologies using passive sensor arrays. In a subsequent development phase, these will be used to create active sensor arrays with integrated CMOS drive electronics. The goal is to achieve a technology readiness level (TRL) of 4 with the demonstrators developed in the project.

About Fraunhofer IPMS

Fraunhofer IPMS is a world-renowned research and development service provider specializing in electronic and photonic microsystems. Our technologies are used in industries such as mobility, biotechnology, and medical technology. We are also addressing key future fields, such as quantum technologies and neuromorphic computing. Through our research in green microelectronics, we contribute to a sustainable and resource-efficient world. In our 200-mm cleanroom, we offer a full range of services for the development of microelectromechanical systems (MEMS) and micro-opto-electromechanical systems (MOEMS) on 200-mm wafers—all of which are fully CMOS-compatible.

Image

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Infrared sensors (front) and an illustration of a measurement. © Heimann Sensor