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Research into novel microelectrodes: Dr. Maximilian Becker receives NanoMatFutur funding

With the FeMEA project – Ferroelectric Microelectrodes for Biomedical Applications – Hahn-Schickard is setting a pioneering course in bioelectronics research. The aim of the project is to develop novel microelectrode arrays in which ferroelectric materials are used as functional interfaces in CMOS chips for the first time. For this innovative approach, the project was awarded funding in the highly competitive NanoMatFutur competition organized by the German Federal Ministry of Research, Technology, and Space (BMFTR) and will receive €1.95 million over five years.

The research addresses a key challenge in bioelectronics: reliable, high-resolution, and long-term stable communication between electronic components and biological systems. While conventional capacitive electrodes with dielectric insulators as interface materials have limited stimulation efficiency, the microelectrode arrays developed in FeMEA utilize the special properties of ferroelectric insulators—in particular, their switchable surface charge, which remains even after the voltage is switched off.

“With the ferroelectric effect, we achieve a significant increase in the stimulation current while simultaneously suppressing harmful electrochemical currents. This improves the long-term stability and safety of bioelectronic interfaces,” explains Dr. Maximilian Becker, FeMEA project manager and group leader for Biosensors and Wearable Sensors at Hahn-Schickard.

Dr. Becker earned his doctorate in physics at the University of Tübingen, where his research was conducted in collaboration with the Natural and Medical Sciences Institute (NMI) in Reutlingen. After conducting international research at the University of Cambridge, he is now establishing a new working group at Hahn-Schickard with NanoMatFutur funding.

“We are delighted that the FeMEA project has been recognized by the BMFTR. FeMEA is an innovation with great potential for scientific breakthroughs in bioelectronics. Hahn-Schickard supports the research right through to transfer. We see numerous areas of application for FeMEA in particular,” adds Prof. Oliver Amft, Director of the Institute.

Microelectrode arrays are miniaturized, electronically addressable systems for the electrical recording and stimulation of cells, such as nerve cells or heart muscle tissue. More than 5,000 microelectrodes, each barely wider than a human hair, can operate simultaneously on less than one square millimeter of chip surface area. They create a precise connection to the biological environment and enable novel applications in biomedicine.

The first CMOS microelectrode arrays with ferroelectric coating have already been successfully implemented. The technology is protected by a granted patent, and further patent applications are pending.

With funding from NanoMatFutur, the FeMEA project (funding number 13XP5238) not only receives financial support, but also visibility in one of Germany's most renowned programs for promoting young talent. It is specifically aimed at young researchers with vision and offers the opportunity to establish a research group with industrial connectivity.

Press release

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Further information

- Hahn-Schickard-Gesellschaft für angewandte Forschung e.V.