

Press Release

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Life Cycle Analyses Reveal Potential for Resource-Efficient Electronics Development

Sustainable Medical Electronics Can Reduce Environmental Impact by Up to 65 Percent

In the European research project SUSTRONICS (SUSTainable electRONICS), researchers from Fraunhofer IZM, together with 45 partners from research and industry and under the coordination of Philips Nederland B.V., are investigating how electronics for the healthcare sector and the automotive industry can be made more resource-efficient across their entire life cycle. The results show that alternative materials, optimized designs, and early-stage life cycle assessments can significantly reduce CO₂ emissions and resource consumption as early as the development phase. With its extensive expertise in life cycle analysis and environmental assessment, Fraunhofer IZM is making a particular contribution to the development of sustainable medical and diagnostic electronics.

While electronic devices have become an integral part of everyday life, the consumption of critical raw materials and energy demand associated with their production continues to rise. According to the European Commission's European Green Deal, Europe aims to become climate-neutral while maintaining a competitive economy by 2050, which calls for new approaches that consider sustainability not only at the end of a product's life cycle, but already during the development phase.

This is precisely where the large-scale SUSTRONICS project comes in. The consortium, comprising partners from 11 European countries, is developing new technologies and methods to make electronics more sustainable throughout their entire life cycle. The focus lies on resource-efficient materials, printed electronics, energy-efficient manufacturing processes, and concepts for reuse, repair, and recycling.

The scientists are testing the technologies provided by manufacturers in ten demonstrators from various application areas, including medical diagnostic systems such as EEG devices, smart wound dressings, and wearable sensors.

Sustainable Medical Technology at the Center of Fraunhofer IZM's Work

A central role in the project is played by reliability testing and life cycle assessments (LCA), which the Fraunhofer Institute for Reliability and Microintegration IZM carries out, particularly for the demonstrators from the medical and diagnostic technology field. Using scientifically grounded environmental assessments, the researchers around Fraunhofer IZM scientist David Sánchez analyze the entire life cycle of the developed products - from raw material extraction through manufacturing to use and end-of-life. This allows them to identify hot spots: specific processes within the product life cycle that have particularly high environmental impacts, and whose identification enables targeted optimization. Through various LCAs examining global

warming potential, critical material use, and toxicity in detail, they found that electrodes were almost single-handedly driving the impacts for glucose monitoring patches. As the scientists feed these findings directly back to their development partners, enabling them to replace materials, adapt manufacturing processes, or optimize product design before the products move into the next development phase, project partner Onalabs could then implement an optical sensor in such a patch, thereby reducing its overall carbon footprint by around 65 percent.

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The choice of materials, not just the technologies used, also plays an important role, as the team demonstrated for smart wound dressings: „Simply by using different substrates and conductive inks, such as Thinstar and carbon as a replacement for silver, as well as the use of recycled materials, the environmental impact of the flexible electronic modules in the product can be reduced by up to 95%, compared with the standard material combination of PET and silver.“ summarizes David Sánchez from Fraunhofer IZM's Environmental Department.

Sustainability as a New Standard in Production

SUSTRONICS aims to establish sustainability as a fixed component of European electronics development. The methods and results developed within the project are intended to be applied beyond the demonstrators as well, providing an important foundation for companies seeking to systematically incorporate environmental considerations throughout their entire development process.

Sánchez sums it up: „By providing meaningful data for environmental assessment, Fraunhofer IZM makes an important contribution to the environmentally friendly design of electronic products, starting as early as the R&D phase. SUSTRONICS offers a holistic approach and can serve as a flagship project for a sustainable circular economy - for stakeholders from industry, research, and policy alike.“

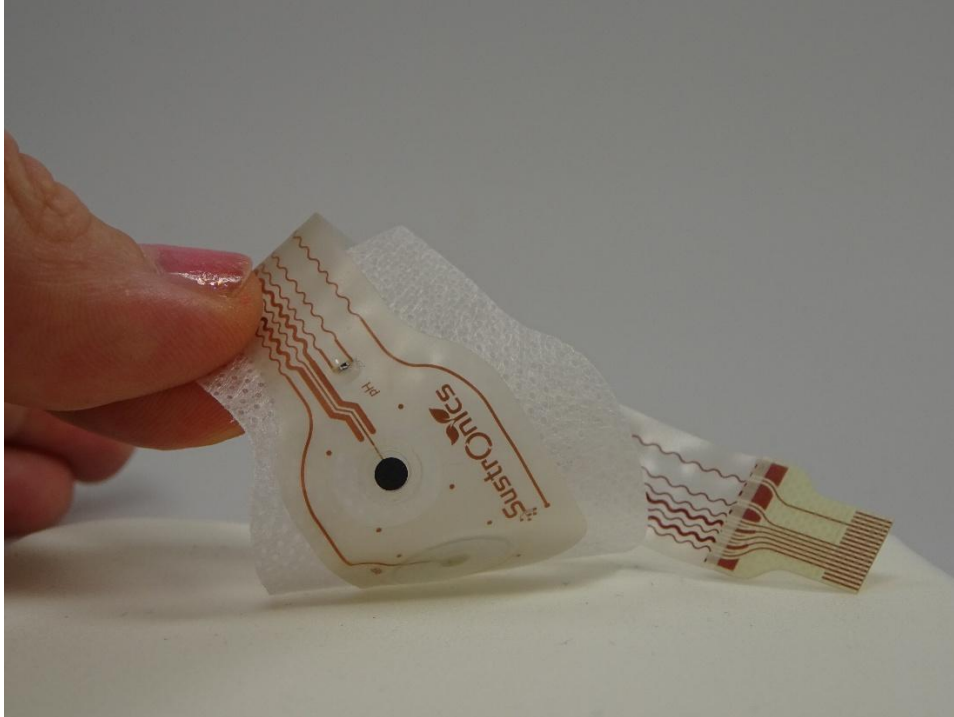
The project ran from June 1, 2023 to May 31st, 2026, and was supported under the Chips Joint Undertaking (grant agreement no. 101112109), including additional funding from the Netherlands, Austria, Germany, Spain, Finland, France, Latvia, Poland, and Sweden. The work was also funded with €1.71 million by the German Federal Ministry of Research, Technology and Space (BMFTR) and the Swiss State Secretariat for Education, Research and Innovation (SERI).

Project partners

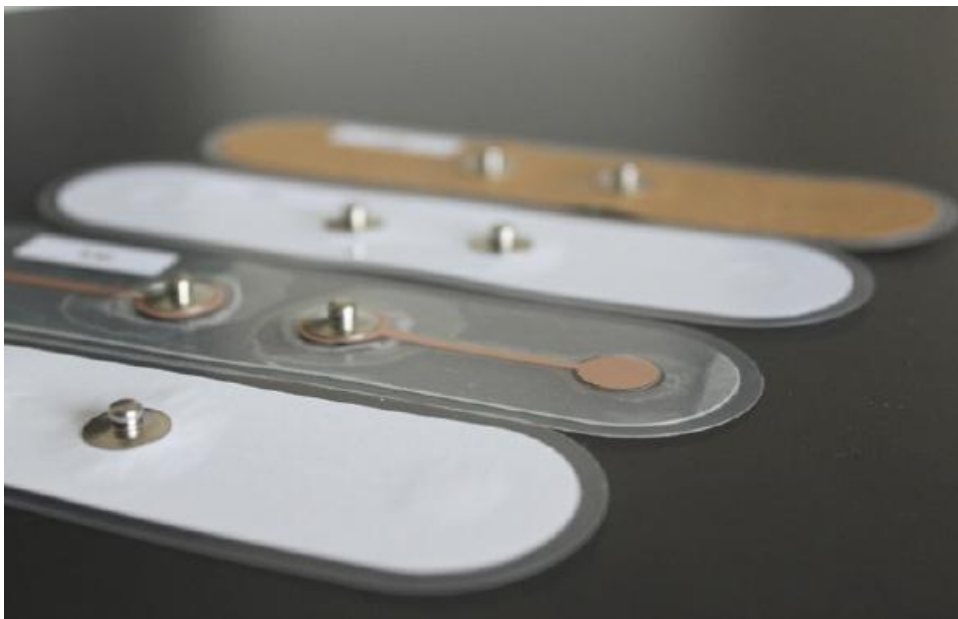
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(Text: Lotta Jahnke)



Bio-based TPU Smart Wound Dressing with Temperature and pH Sensing on a Skin-Conformal Patch © Photo: Fraunhofer IZM/Barbara Pahl | Print quality images: www.izm.fraunhofer.de/pics



Electrodes made of paper and copper paste produce signals comparable to those of the current gold standard and perform significantly better in all tests measuring environmental impact. © Photo: Screentec

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The **Fraunhofer Institute for Reliability and Microintegration IZM** is one of the world's premier research institutions for electronics packaging. With its dedication to developing miniaturized, high-reliability electronics in cutting-edge lab facilities, the institute works to maintain the competitive edge of Germany and Europe.

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