

FRAUNHOFER INSTITUTE FOR PHOTONIC MICROSYSTEMS IPMS

# PRESS RELEASE

PRESS RELEASE

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Successful HZO Ferroelectric Wafer Loops Confirm Functionality Across FAMES Sites

## **CEA-Leti and Fraunhofer IPMS Validate Wafer Exchange For Ferroelectric Memory Materials Within the FAMES Pilot Line**

**CEA-Leti and Fraunhofer IPMS have successfully completed the first exchange of ferroelectric memory wafers within the FAMES Pilot Line, marking a pivotal milestone in establishing a shared European platform for advanced embedded non-volatile memory technologies. Launched in December 2023 and coordinated by CEA-Leti, the five-year initiative has demonstrated the viability of circulating complex material stacks across some of its leading research fabs.**

The collaboration has been first focused on the processing and electrical characterization of hafnium-zirconium oxide (HZO) ferroelectric capacitor stacks. Utilizing the combined 300 mm CMOS cleanroom capabilities of both institutes, the wafers were circulated in short process loops to enable joint evaluation of materials, electrode configurations, and device behavior.

The work also validated the wafer exchange and contamination-control protocols implemented in the Pilot Line, demonstrating that complex material stacks can be processed reliably across multiple advanced semiconductor facilities, on all wafers.

The entire process adhered to standardized contamination control procedures, verified through VPD-ICP-MS (Vapor Phase Decomposition – Inductively Coupled Plasma Mass Spectrometry) and TXRF (Total Reflection X-Ray Fluorescence) analytics. Devices were evaluated using a FeCAP array test vehicle designed by CEA-Leti, with electrical characterization performed via the PUND (Positive-Up-Negative-Down) methodology to isolate true ferroelectric switching from parasitic effects.

### **Accelerating the Path Toward System-Level Application**

"The successful wafer exchange marks an important step toward a joint European material testing platform for ferroelectric memories," said Dr. Wenke Weinreich, Division Director of Fraunhofer IPMS' Center Nanoelectronic Technologies, a member of the 11-member consortium. "By combining our processing expertise with CEA-Leti's CMOS integration capabilities, the pilot line provides a powerful environment for evaluating new ferroelectric stacks and accelerating their path toward system-level applications."

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#### **Editor**

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Initial experimental results have already yielded critical insights. The team screened various electrode materials to enhance performance, finding that titanium nitride (TiN) bottom electrodes significantly outperform tungsten (W). In reliability tests, TiN exhibited lower failure rates after  $10^7$  field cycles at 4 MV/cm. Furthermore, clear cross-split effects were observed across different electrode configurations, confirming the sensitivity of the test vehicles to process variations.

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### Seamless Exchanges Across FAMES' Sites

"This first exchange between CEA-Leti and Fraunhofer IPMS demonstrates that shared process flows, test vehicles, and characterization environments can work seamlessly across FAMES' sites," noted project Coordinator Dominique Noguét. "Establishing reliable wafer loops between leading research fabs is essential for accelerating ferroelectric memory development."

Looking ahead, the wafer loops lay the groundwork for broader collaborative development. Upcoming phases will integrate HfO<sub>2</sub>-based ferroelectric stacks from Fraunhofer IPMS into CEA-Leti CMOS processes, followed by array-level evaluations of state-of-the-art memory technologies embedded in the upcoming GlobalFoundries' 22nm FDX® Memory Advanced Demonstrator Multi Project Wafers shuttle prepared by CEA-Leti. The roadmap also includes studies on electrode process variations, long-term reliability, and back-end-of-line integration approaches.

In parallel, Fraunhofer IPMS recently completed a first chip tape-out using GlobalFoundries' 22nm FDX® technology and initiated research on algorithm-based AI compute-in-memory accelerator architectures built on these ferroelectric technologies.

Together, these efforts advance the core mission of the FAMES Pilot Line: to provide a unified European platform for developing and validating emerging memory technologies—including OxRAM, MRAM, FeRAM, and FeFET. By enabling collaborative material development and standardized characterization, the initiative aims to strengthen Europe's capacity to design and manufacture the low-power, next-generation chip architectures required for the future of computing.

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#### About Fraunhofer IPMS

Fraunhofer IPMS is a leading international research and development service provider for electronic and photonic microsystems in the fields of intelligent industrial solutions, medical technology and health, mobility, and green and sustainable microelectronics. Its research focuses on customer-specific miniaturized sensors and actuators, MEMS systems, microdisplays, and integrated circuits, as well as wireless and wired data communication. Its services range from consulting and design to process development and pilot series production. With the Center Nanoelectronic Technologies (CNT), Fraunhofer IPMS offers applied research on 300 mm wafers for microchip producers, suppliers, device manufacturers and R&D partners.

Visit <https://www.ipms.fraunhofer.de/en.html>

#### About CEA-Leti

CEA-Leti, a technology research institute at CEA, is a global leader in miniaturization technologies enabling smart, energy-efficient and secure solutions for industry. Founded in 1967, CEA-Leti pioneers micro- & nanotechnologies, tailoring differentiating applicative solutions for global companies, SMEs and startups. CEA-Leti tackles critical challenges in healthcare, energy and digital migration. From sensors to data processing and computing solutions, CEA-Leti's multidisciplinary teams deliver solid expertise, leveraging world-class pre-industrialization facilities. With a staff of more than 2,000 talents, a portfolio of 3,200 patents, 14,000 sq. meters of cleanroom space and a clear IP policy, the institute is based in Grenoble (France) and has offices in San Francisco (United States), Brussels (Belgium), Tokyo (Japan), Seoul (South Korea) and Taipei (Taiwan). CEA-Leti has launched 80 startups and is a member of the Carnot Institutes network. Follow us on [www.leti-cea.com](http://www.leti-cea.com) and @CEA\_Leti.

#### Technological expertise

CEA has a key role in transferring scientific knowledge and innovation from research to industry. This high-level technological research is carried out in particular in electronic and integrated systems, from microscale to nanoscale. It has a wide range of industrial applications in the fields of transport, health, safety and telecommunications, contributing to the creation of high-quality and competitive products.

For more information: [www.cea.fr/english](http://www.cea.fr/english)

#### About FAMES Pilot Line

FAMES (FD-SOI Pilot Line for Applications with embedded non-volatile Memories, RF, 3D Integration & PMIC, to ensure European Sovereignty) gathers leading RTOs and academic partners to develop five key technologies and an eco-innovation program that will enable new chip architectures. The project includes an open access program to

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enable semiconductor stakeholders to gain access to the Pilot Line and the FAMES technologies, and a comprehensive training program.

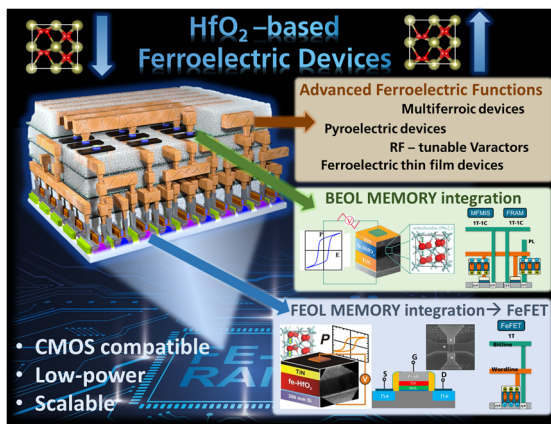
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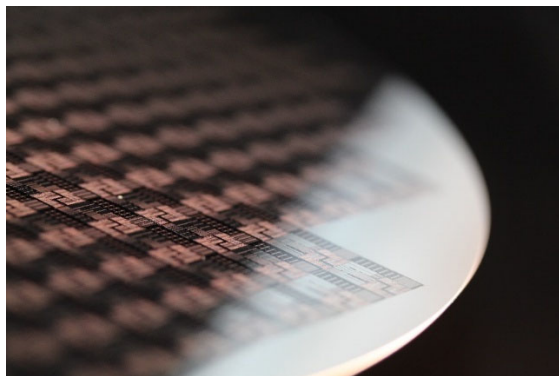
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**Images**



*Illustration of HfO<sub>2</sub>-based ferroelectric devices enabling scalable, CMOS-compatible non-volatile memory. The architecture supports integration in both front-end (FeFET) and back-end memory structures, while opening pathways to advanced ferroelectric functionalities such as multiferroic, pyroelectric, and tunable RF devices.*  
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*FeFET wafer*  
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