FerroNEXT

Ferroelectric Neuromorphic Extended Testing

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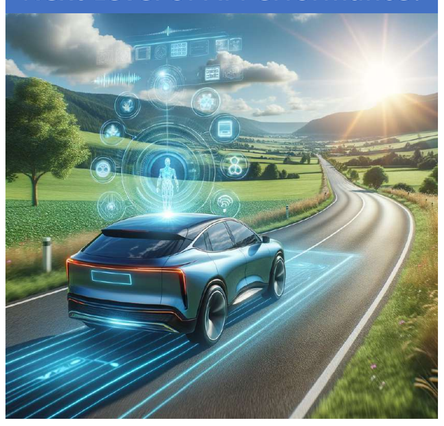
1 Current Status and Project Goals

- Ferroelectric (FE) devices, including FeFETs, FeMFETs, and FeRAM, show great potential for AI hardware applications.
- The absence of standardized testing solutions hampers comparability of FE device development progress.
- Existing testing systems lack necessary measurement speed and resolution to meet practical application requirements.
- A suitable material for use as calibration standards in testing tools has yet to be identified.

FE Devices: The Key to the Next Level of AI Performance!



Challenges and Objectives:

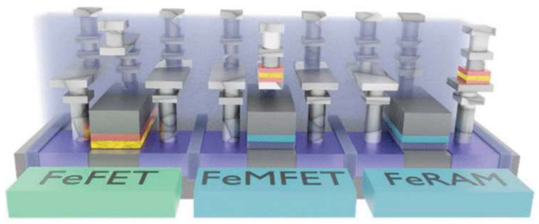
- **Innovative Testing Methods:** Design and standardization of cutting-edge testing solutions tailored for neuromorphic systems.
- **Performance Enhancement:** Increasing measurement speed and achieving superior resolution to meet advanced application needs.
- **Reference Samples:** Production of reliable FE reference samples for consistent benchmarking.
- **Calibration Standards:** Assessment of FE material systems to identify their suitability as calibration standards.

2 Innovation

FerroNEXT:
Development of a test system demonstrator for precise characterization of FE devices and standardized reliability measurements.

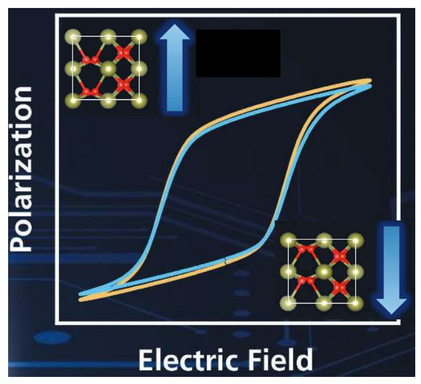
Technological Advancements:

- Development and deposition of FE thin films with stable, reproducible FE properties.
- Design and fabrication of parallel-connected capacitor arrays to increase overall area and assess device scalability.



Measurement Advancements:

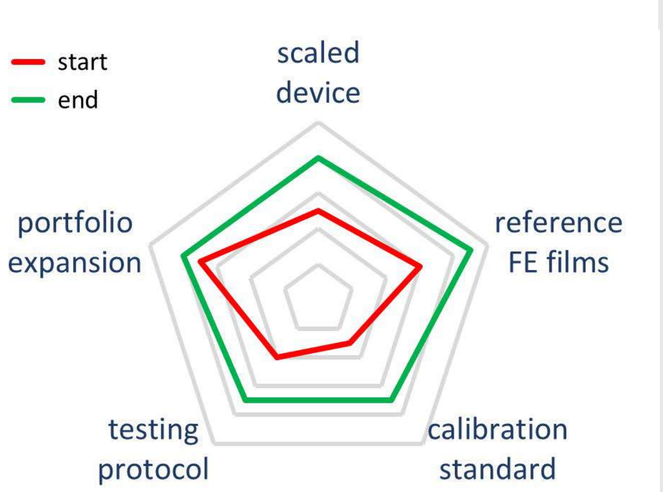
- **Analog Switching:** Precise characterization of analog memory states.
- **Imprint & Retention:** Standardization of reliability measurements.
- **Measurement Speed:** Cycle endurance measurements at frequencies above 1 MHz.



3 Future Performance Profile & Skills of the Project Partners

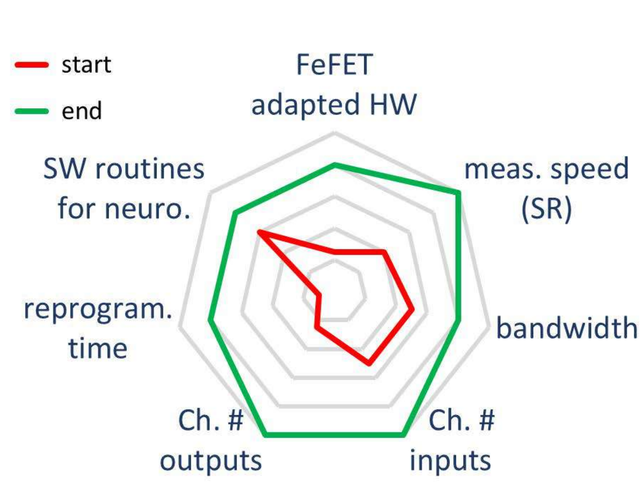
FerroNEXT will strengthen **Fraunhofer IPMS's** capabilities by

- enabling the fabrication of more scaled FE devices
- improving the reproducibility and stability of reference FE films
- including a calibration standard
- providing enhanced testing protocols for reliability tests of FE devices, and
- expanding its portfolio of characterization methods and scientific publications.



aixACCT Systems will extend the test capabilities for FE devices towards the requirements of neuromorphic applications. Key metrics of these extensions include

- basic measurement specifications tailored for FeFETS
- measurement speed and bandwidth
- measurement channels for more complex test functions
- fast adaptive reprogrammable test scenarios
- enhanced SW measurement routines



4 Prospects

- **Increased Comparability of Results:** Development of standardized measurement approaches improves the comparability of research results across institutions, boosting efficiency in device development.
- **Accelerated Development Efficiency:** Unified methodologies speed up progress in the field.
- **Beyond Memory Applications:** Insights gained can benefit energy harvesting, FE sensors, and actuators, broadening the scope of functional material applications.
- **Strengthened Collaboration:** Enhanced cooperation between project partners, fostering synergy and knowledge exchange, which accelerates innovation cycles.

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