

Hafnium-based FeRAM memories

Advanced non-volatile memories

What is FeRAM?

Memories are electronic components used for the temporary storage of data. There are two main categories of memories, stand-alone (e.g. USB key) and embedded memories. Nowadays, embedded solutions are gaining much interest and non-volatile memories appear as the prime choice. In fact, their ability to retain data, even when deprived of power supply, make them critical for many applications.

There are different categories of non-volatile memories. One of them is FeRAM—Ferroelectric Random Access Memory. FeRAMs provide key advantages:

- Low consumption: 10fJ/bit
- Fast and low voltage: <100 ns and <3V
- High endurance: Up to 10^{15} cycles

Applications

CEA-Leti can help industrial partners replace current, standard non-volatile memories with FeRAMs for several applications, including:

- Security and smart cards
- Edge AI

In the longer term, CEA-Leti can also help the following business segments migrate to FeRAMs:

- ICT
- Consumer and industrial goods
- Automotive

What's new?

Current FeRAMs are based on PZT material. However, these technologies have two drawbacks:

1. PZT contains lead—a material prohibited by European regulations
2. They are hardly extensive or scalable

To make sure FeRAMs operate at their full potential, CEA-Leti introduced new hafnium-based materials (HfO_2 and HZO). Hafnium-based materials are changing the FeRAM paradigm by offering:

- Excellent CMOS compatibility
- Flexibility vs. perovskite materials
- Easy integration into a 3D-stacked capacitor

What's next?

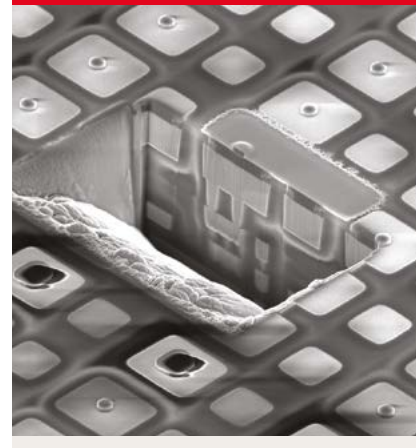
CEA-Leti's team has recently demonstrated 16 kbit FeRAM functional arrays in 130 nm and is now working towards more complex demonstrators using 22 FDX technology. The goal is to have these demonstrations achieved by end of 2023.

European Project

- 3eFERRO

Publication

IEDM 2021 of T. François: "16kbit HfO_2 -Si-based 1T-1C FeRAM Arrays Demonstrating High Performance Operation and Solder Reflow Compatibility"



Interested in this technology?

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