

News & Analysis

4DS Enlists IMEC to Advance ReRAM

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TORONTO — A resistive RAM (ReRAM) company that recently claimed its storage-class memory technology was as fast as DRAM is collaborating with IMEC to develop a production-compatible process.

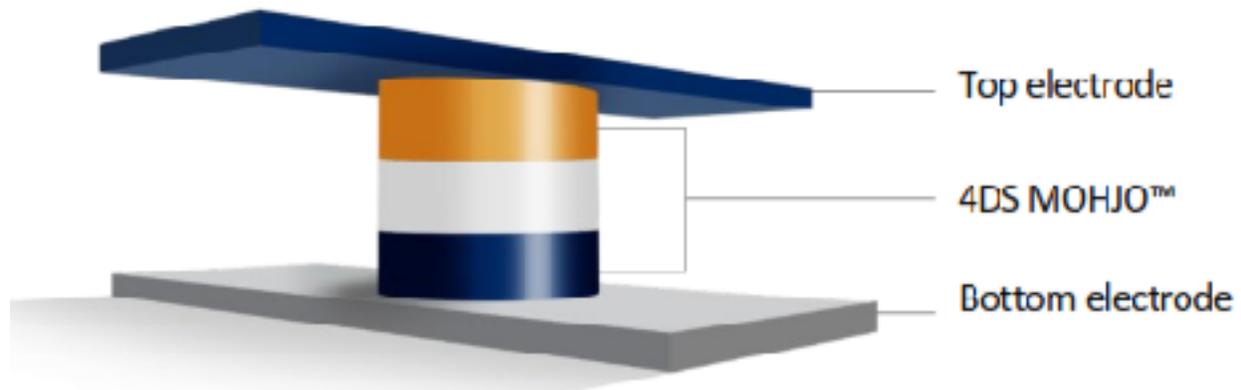
4DS Memory Limited [announced in June](#) it had successfully tuned its Interface Switching ReRAM cell architecture to storage class memory with read speeds comparable to DRAM without needing speed-limiting error correction. Last year, the company announced it had scaled these cells to 40nm, but until now these cells have been fabricated with R&D process tools that differ from those used for high-density, high-volume memories in production fabs.

The 4DS Interface Switching ReRAM technology is area-based as cell currents scale with cell area and the wiring therefore scales accordingly, the company says, and the technology is also based on well-understood physics and chemistry.

In a telephone interview with EE Times, 4DS CEO Guido Arnout said now that after scaling down to 40nm and showing both predictability and repeatability, 4DS felt it was the right time to approach IMEC with its unique cell. The collaboration will demonstrate 4DS' production backend-of-line (BEOL) process on IMEC's CMOS megabit memory vehicle processed at 300mm wafers to make 1Mb devices, he said.

Arnout said flash is getting cheaper by the day, so competing with it means undercutting prices significantly. 4DS, however, sees a gap between flash and DRAM for another storage-class memory. "The space between flash and DRAM is huge," he said.

As one of the leading microelectronics R&D organizations in the world, IMEC is in a strong position to help 4DS tweak its technology for finer geometries and learn everything it can about its cell in terms of yield, speed and endurance for commercial production, Arnout said. "We can't cut corners because we don't want to fail," he said. "If we cut corners, we won't get the answers."



4DS' ReRAM includes a patented cell structure and operation called MOHJO — metal oxide hetero junction — and a non-filamentary switching mechanism.

Doing such work in a research foundry concept is an efficient solution, said Lode Lauwers, IMEC's vice president of business development and sales, as these projects build the confidence and the level of maturity by which potential fabs will consider adopting such processes.

"Fabs introduce new materials all the time, but they only do so if one has sufficiently demonstrated the prevailing properties and addressed the potential side effects to assure that no showstoppers occur," Lauwers said. "Assessing those options as complete as possible in the R&D phase is one key element in IMEC's programs."

It's critical that emerging memories continue to use existing materials, tools and processes, Lauwers said. Nearly all new emerging memories — be it magnetic, resistive or phase change — build on the properties of new materials or material combinations. "These days, more than half of Mendelejev's table is under investigation to create material systems based on multiple components for experiments in memory process steps, which is impressive," Lauwers said. "Of course, with new materials comes the need to develop new processes, fab handling, integration concepts, and tooling."

Lauwers said "healthy conservatism" has driven the industry's progress. "If one could realize the properties of functionality with a known system, that would definitely always be the preferred option," he said.



Lode Lauwers

From a research perspective, however, tackling fundamental challenges means rethinking what you have, understanding its limitations, and discovering new areas, including new materials, that have a promise to overcome those limitations, he said.

ReRAM, as well as MRAM, are still considered emerging technologies. "They are at the eve of breakthrough, but still subject of many intensive research and development projects, even if those projects are already ongoing for many years," Lauwers said.

Jim Handy, principal analyst with Objective Analysis, said IMEC has an advantage because of its wide array of sponsors that enable it to afford better equipment and justify having a large number of tools on hand that a commercial production environment can't justify. At the same time, it's essential that it take an emerging technology the next step, making sure it can be affordably produced with available tools and processes, he added.

"This is to make sure this is a production worthy process," Handy said. "You can do things in an R&D fab that would bring a production environment to its knees."

Handy said the fact that Intel has been calling its 3D Xpoint technology ReRAM is probably what's renewed the industry's interest in ReRAM, which has been around a long time, as has 4DS. "This is the first time [4DS has] shown earnest effort to turn their technology into something that's production worthy," Handy.

—Gary Hilson is a general contributing editor with a focus on memory and flash technologies for *EE Times*.

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