CASE STUDY

Syenta

How an Australian company is solving one of AI's biggest bottlenecks

In just a few years, AI has become a technology hundreds of millions of people use every day, from running complex research simulations to planning a holiday.

Each time AI responds to a prompt, it needs to move data between components such as processor chips and memory chips. These chips contain billions of tiny electronic switches called transistors, which are made of semiconducting materials.

For 40 years, researchers have worked on making transistors smaller, allowing more of them to fit on a single chip. This allows computers to perform more calculations faster and has led to a 60,000-fold growth in computing power in the past 2 decades.

Now, the bottleneck has moved.

Instead of computing power, the limiting factor in AI systems now is how fast data can move between memory and processing chips.

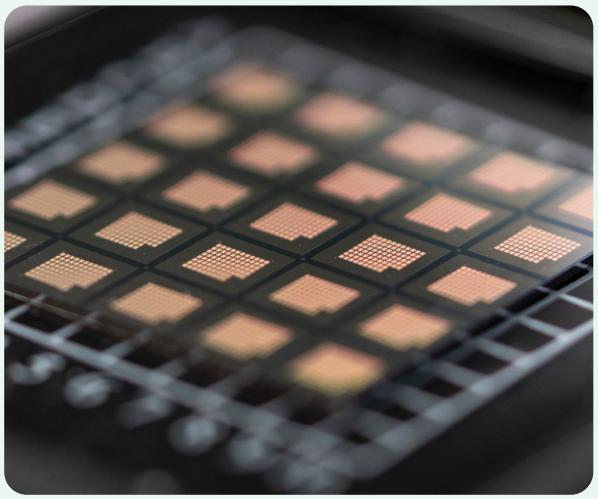
Australian semiconductor technology company Syenta is working to address that challenge. Its technology demonstrates the opportunity for Australia to turn locally developed research into globally competitive semiconductor products.

The company has developed a new way to break through the 'AI memory wall' using a unique fabrication method called Localised Electrochemical Manufacturing (LEM).

"Every time you run an AI model, data has to move back and forth between compute and memory, and that highway is now completely congested," said Dr Jekaterina Viktorova, CEO and founder of Syenta.

"The industry is trying to fix this by adding more 'lanes' – called interconnects. But to do that you have to make the wiring smaller and smaller. That's where our technology comes in: we can create ultra fine interconnects at sub-micron scale, so you can build many more high-performance highways in the same space."

LEM was born out of research at the Australian National University, where Dr Jekaterina Viktorova completed her PhD. It offers significant advantages over conventional semi-additive processes: instead of requiring many separate steps, LEM can produce ultra-fine interconnects in only a single step, while using roughly 140 times less energy per layer and substantially fewer chemicals, all at an unmatched resolution and cost. Technologies such as LEM highlight the potential for Australian innovation to build strength in emerging areas of the semiconductor sector.



Images courtesy of Syenta

"The industry standard for interconnect resolution around the world is 2 microns. Syenta's technology allows us to produce one micron, and even sub-micron, architectures," said Dr Jekaterina Viktorova.

Its potential to address this major AI bottleneck has attracted interest from leading chip designers and manufacturers worldwide, as well as national and international investment. The technology could be used to manufacture chips globally, supporting emerging areas such as quantum, with Syenta retaining exclusive control of the IP for the process and design, stamp manufacturing, and chemistry.

Pat Gelsinger, former CEO of Intel and general partner at Playground Global, said, "AI's next scaling challenge isn't just compute, it's how chips connect. What's compelling about Syenta is that the company is tackling a key constraint in advanced packaging and contributing to the expansion of a more resilient global semiconductor ecosystem."

Syenta's story shows that Australia has an opportunity not to replicate what established semiconductor leaders already do, but to build competitive advantage in emerging areas where Australian innovation offers something different.

More than 90% of current advanced packaging is manufactured in Taiwan and there are manufacturing backlogs of 18–24 months. That translates into billions, if not trillions, of dollars of unmet orders worldwide. Syenta's technology directly addresses this bottleneck.

To continue growing and scaling in Australia, Syenta will need access to commercial-scale fabrication infrastructure, patient capital, and internationally competitive incentives. Supporting companies like Syenta to commercialise and grow locally could help retain more capability, IP and economic value in Australia.

"Australia will not compete by doing what everyone else is already doing in the semiconductor industry," said Dr. Jekaterina Viktorova. "We will be competitive by being early to the next disruptive innovation, and by backing the science, the people and the companies that can industrialise Australian research into globally relevant technology."