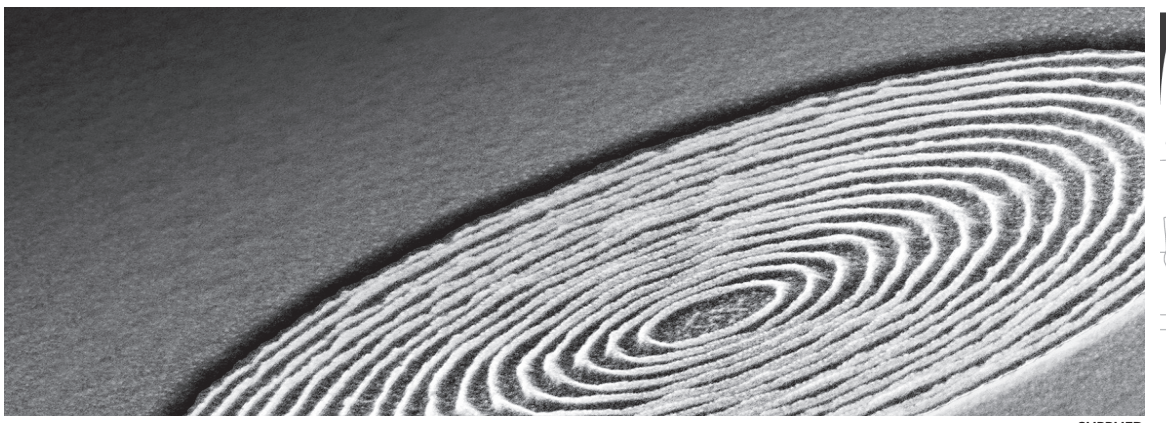

SUPPLIED

WHEN SMALL IS IMPRESSIVE This ten nanometre wire has the possibility to change the world of technology.

Big future for NINT nanowires

RYAN HEISE
Deputy News Editor

Researchers at the University of Alberta's National Institute of Nanotechnology (NINT) have potentially paved the way for the future of semiconductors with the development of extremely small conductive wires.

"The idea for this project is that technology … is getting smaller and smaller, but the technology for nanofabrication is still in the length of microns and hundred nanometers (nm)," explained Steven Chai, a graduate student who has been working on the nanowire project since 2005. He said that a whole new fabrication process for nanostructures is needed to realize the future of technology.

The team, headed up by NINT senior research officer Jillian Buriak, set out to address this issue and do it in the most economical and efficient way.

"Making things this size is very expensive," Buriak said. "So people would like to come up with ways that would allow you to build [nanowires], but not have to go in and design each one."

The results of their work is a technique that does much of this hard work for the researchers, essentially creating a very small, uniform mould for the wires.

The process begins with a block co-polymer—a polymer made up of two different materials about 40nm across—being placed on a silicon chip. The polymer is then heated to about 200 degrees to make the molecules more active. When this happens, the polymers naturally self-assemble into cylindrical lines on the surface of the chip, and the two different polymers separate. The polymer is then filled with metal ions to create the wire. Finally, plasma is used to remove the polymer, leaving behind only the metal ions that were shaped by the polymer channels.

> **"Making things this size is very expensive."**
>
> **JILLIAN BURIAK**
> NINT SENIOR RESEARCH OFFICER

The outcome is wires that are approximately 10nm across. In comparison, the wires used in high-end microprocessors today are 65nm.

Chai and Buriak agreed that the block co-polymers are the key to the process, as they self-assemble into structures resembling lines, completing the researchers' hardest task.

While the method is a huge breakthrough in the development of semiconductors, the process still requires some refinement.

Chai also explained that working with increasingly smaller components changes their properties somewhat.

"Material property at the nano scale is a little bit different than the material property at the microscopic scale," he said.

The uses of the wires will vary greatly. Consumer applications will most likely be seen in the development of more efficient microprocessors and tiny power sources and interconnects for components on chips. Medical applications for multi-array sensors that can monitor hundreds of thousands of different actions in the human body in real time might also be possible.

As Buriak put it, "Rather than saying 'Can you pee in this cup, Mr Jones?', and then you analyze for three things. It's so primitive compared to what people are thinking of."

But Buriak said that the development of these nanowires would perhaps have the greatest impact on the future of the Semi-Conductor Roadmap, a document created by industry-leading companies and researchers that sets out the path for semiconductor development.

"The roadmap is fantastic because it has highlights in red, and these highlights in red are for things … 'for which there are no known manufacturable solutions,'" she said. "When you get to 2018—when things are sub-20nm—there's so much red that they've termed this the 'red brick wall.' It's the end of the line; we don't know how the heck we're going to make this.

"The point is, can you come up with ways that will allow you to continue making smaller and smaller feature sizes on chips that's economical and manufacturable?" she asked. "Using block co-polymers is definitely manufacturable."

NEWS BRIEF

AS GLOBAL WARMING TAKES FLIGHT, BUTTERFLIES MAY SUFFER

Global warming is beginning to diminish the habitat of the alpine Apollo butterfly.

According to a study conducted by researchers at the University of Alberta and published in the *Proceedings of the National Academy of Sciences*, the rising temperatures brought about by global warming has caused the tree line in the Rocky Mountains to elevate. As a result, this expansion of alpine forests is leaving little living space for animals that prefer non-forested habitats.

The Apollo butterfly, otherwise known as *Parnassius*, could be at particular risk, as they require a lot of time in the sun in order to generate the body heat that they need to fly. For this reason, they are most often found in meadows and areas without substantial amounts of shade.

Dr Jens Roland, lead author of the study and a professor of biological sciences, explained that the butterflies could become endangered.

"It's not threatened at this point, but similar species in Europe are quite threatened, so these results are relevant to other species," he said.

Roland added that since Alberta forests are beginning to invade meadows and rob them of sunlight, the butterflies may become hard-pressed to survive within a few decades. Not only does the growth of new forests cause the butterflies' habitat to shrink, it also prevents them from moving to other open areas, thereby isolating them from their counterparts and potential mates.

Currently, national parks initiate controlled forest fires in an attempt to preserve certain habitats and maintain the populations of larger mammals. Roland suggested that similar action could be taken for the alpine Apollo butterfly.

"Fire does tend to reset tree lines which are over-elevated," Roland said. "They do prescribed burning for things like elk and mountain sheep, but there would also be benefits for smaller organisms and things like butterflies."

—Brendan Cox, News Writer

SHAUN MOTT

BUTTERFLY BLUES Global warming is threatening the Apollo butterfly.