

MIT Develops Self-Assembling Computer Chips

Researchers at MIT (Massachusetts Institute of Technology) have developed a method that compels molecules to self-assemble in a manner that could allow for smaller computer chips in the future. Heading the research are Karl Berggren, the Emanuel E. Landsman associate professor of electrical engineering, and Caroline Ross, the Toyota professor of materials science and engineering.

The main purpose of the research is to develop a way to create ever-smaller computer chips at a lower cost. Currently, building a chip requires the use of a process known as photolithography, which uses light shining through a stencil or mask to reveal a pattern on a chip coated with a light-sensitive material called a photoresist. This method has its limits, however: "The smallest features you can replicate from a mask are limited by the wavelength of light," Ross says.

To circumvent this problem, chip builders move on to a process called EBL (electron-beam lithography), which allows the transfer of even smaller patterns onto a photoresist. But this method is slow and costly, because the electron beam must move little by little across the chip to expose the pattern, whereas photolithography can reveal an entire pattern at once. "At present, if you want to make features on the 10 to 20nm scale, you have to use electron-beam lithography, which is a serial process (like handwriting) and very slow," says Ross.

Tiny Hitching Posts

These issues led to MIT's new approach, which greatly reduces the amount of EBL used and, in turn, the time and cost required. In the MIT method, EBL is used to create tiny posts on a silicon chip, onto which specially designed polymers are then deposited. The polymers attach to the posts and, because they are linked in long chains, arrange themselves in useful patterns. "What we do is to use self-assembly to generate these patterns spontaneously over a large area," says Ross. "We use little posts made by EBL to guide the self-assembly and let the polymer do the rest. In this way, we only need to use EBL to pattern less than 5% of the surface and get the rest of the pattern for free."

Although the new MIT method could be used to create smaller computer chips in the future, more research is required. For the time being, however, Berggren and Ross envision the self-assembling approach as a way to create the masks used in traditional photolithography.

by Kris Glaser Brambila

