The New York Times

Bits
Business, Innovation, Technology, Society

For Chip Makers, Hybrids May Be a Way Forward

By John Markoff December 15, 2008 8:08 pm

Searching for new ways to make computers that run faster and use less power, the chip industry is once again eyeing some exotic materials that can offer great speed, but have been more costly and difficult to manufacture than silicon.

The materials, so-called III-V semiconductors, include compounds like gallium arsenide and indium phosphide. The have found their way into military and communications uses, but have largely been relegated to niches by more standard silicon-based manufacturing processes.

The legendary supercomputer designer Seymour Cray used gallium arsenide in his Cray 3 and Cray 4 designs. In general, though, the materials have not had the low-power characteristics that have made conventional silicon chips so cost-effective.

Sometime in the future, however, a new kind of hybrid chip might be made possible by manufacturing techniques that essentially glue together materials with incompatible molecular structures. This could result in chips that integrate radio or optical communications functions. It could also make it possible to run the III-V-based transistors at lower power without losing all of their speed advantages.

At this year's International Electron Devices Meeting, held in San Francisco this week, researchers from both Intel and M.I.T. reported results in using the materials to make ultrafast transistors that are dozens of times faster

than today's silicon-based transistors. In the case of the Intel research, the company has succeeded in creating a blend of both silicon and a III-V compound, indium antimonide, that runs as fast as 140 gigahertz.

Intel executives said the new class of transistors had no immediate product applications, but could help in the future in scaling transistors down to even more Lilliputian dimensions. The company is currently manufacturing chips at the 45-nanometer scale — a measure of minimum transistor feature size — and at this week's meeting it will describe working chips at the next step down, 32 nanometers. Intel can now place about one billion transistors in its most advanced microprocessors, and the next step toward smaller scale, which will double the number of transistors available to circuit designers, will probably take place toward the end of 2009.

It might be four chip generations, however, before Intel adds the new hybrid approach to its commercial chips, said Mike Mayberry, the company's director of components research.

The new technology could have widespread applications in consumer electronics products.

"It might make possible very cheap devices that are everywhere," Mr. Mayberry said. "Things that are so cheap you can throw them away."

During a news conference on Monday, industry executives expressed optimism about the new technique, which they said was still years away from commercialization.

"There are still very serious problems and many challenges, but it looks promising," said Jesus A. del Alamo, an electrical engineering professor who is working in the area and whose research is being partially funded by Intel.

One of the reasons that industry interest is so high is because of the rapidly growing power consumption of consumer gear.

"This is a green transistor," said Albert Chin, one of the organizers of the conference and a professor at National Chiao Tung University in Taiwan.

The researchers also talked about new research on three-dimensional chip structures as a way around the increasing challenges of making smaller microelectronic devices.

Separately on Monday, Intel researchers described another novel technique for gaining computing speed. It involves “rotating” the basic silicon material used to create cylindrical ingots of silicon from which wafers and then chips are cut. This involves changing the way the basic crystalline silicon is “grown,” or extruded — creating a different crystalline structure, which can provide faster switching in some cases.

Comments are no longer being accepted.