World's smallest magazine cover measures 11 x 14 micrometers (w/ Video)

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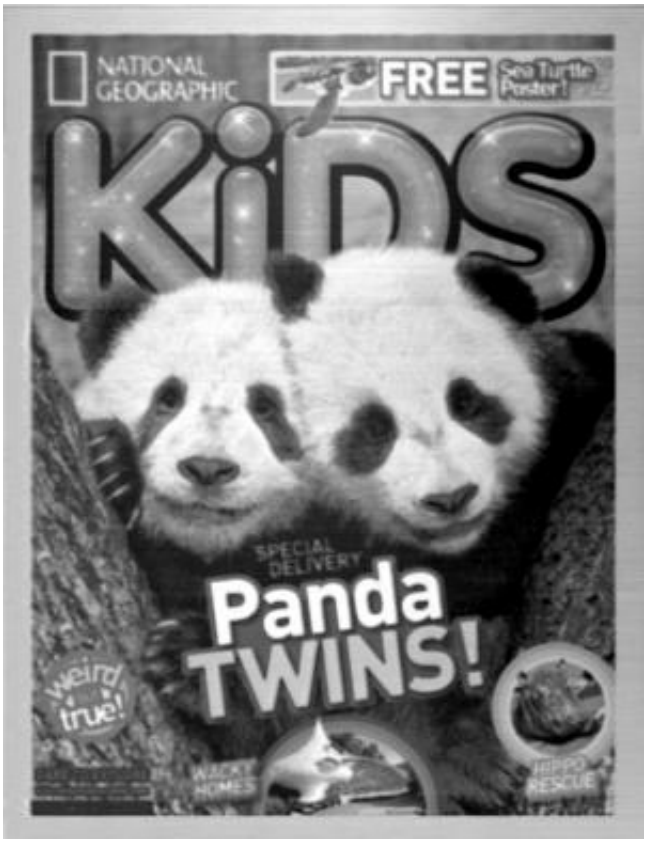


National Geographic Kids today claimed its ninth GUINNESS WORLD RECORDS® title for the Smallest Magazine Cover, using technology from IBM, at the USA Science & Engineering Festival in Washington, D.C. To create the record-setting cover, IBM scientists invented a tiny “chisel” with a heatable silicon tip 100,000 times smaller than a sharpened pencil point. Using this nano-sized tip, which creates patterns and structures on a microscopic scale, scientists etched the magazine cover in less than two minutes onto a polymer, the same substance which creates plastic. The resulting magazine cover is so small at 11 x 14 micrometers that 2,000 can fit on a grain of salt.

To create more energy-efficient clouds and crunch Big Data faster, we need a new generation of technologies including novel transistors. But before we can put these future technologies into mass production, we need new techniques for prototyping below 30 nanometers—the size where prototyping becomes increasingly difficult. One nanometer is 80,000 times smaller than the diameter of a human hair.

Now 50 years old, Moore's Law has nearly reached its limit. For example a processor's clock speed has barely increased in the past five years, with typical operating frequencies between 2–3 GHz. In addition, energy consumption for electronic devices is growing at a staggering rate with estimates reporting that it accounts for up to 10 percent of the total electrical energy generated in industrialized countries.

To continue to scale down the size of transistors, IBM scientists are investigating different materials to replace silicon, and different transistor designs, which of course need to be thoroughly tested before mass production.

Today's nano-scale prototype designs are fabricated using e-beam lithography, which uses a beam of electrons to create custom patterns for testing. But this equipment is complex, expensive and less convenient.

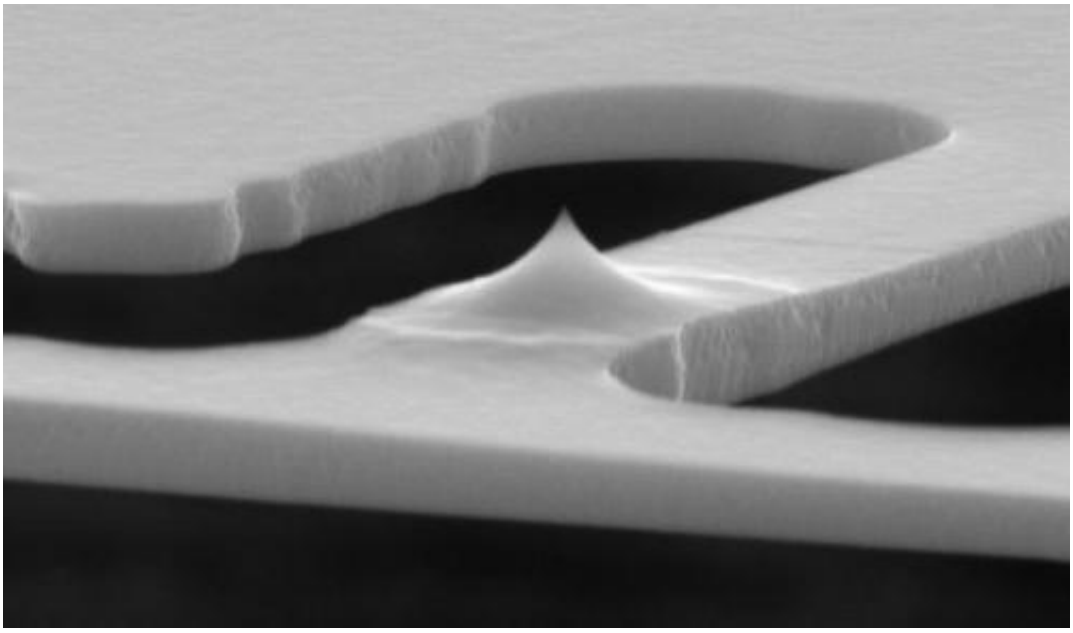
IBM scientists have been working to address these drawbacks, and developed a new tool inspired by hieroglyphics, the written language created by the ancient Egyptians. The core of the technology is a tiny, heatable silicon tip with a sharp apex—100,000 times smaller than a sharpened pencil. Working like a 3D printer it "chisels" away material by local evaporation.

"With our novel technique we can achieve very a high resolution at 10

nanometers at greatly reduced cost and complexity. In particular by controlling the amount of material evaporated, we can also produce 3D relief patterns at the unprecedented accuracy of merely one nanometer in a vertical direction. Now it's up to the imagination of scientists and engineers to apply this technique to real-world challenges," said Dr. Armin Knoll, a physicist at IBM Research.

To demonstrate the tool and to stimulate the enthusiasm for nanotechnology for a new generation of scientists, IBM partnered with National Geographic Kids magazine to "chisel" the world's smallest magazine cover ever. The recently certified GUINNESS WORLD RECORDS cover is 11 × 14 micrometers—at this size 2,000 could fit on a grain of salt. The cover was unveiled at the USA Science and Engineering Festival in Washington, DC.

Current e-beam techniques cannot replicate this new tool's high resolution, and would take several hours before the cover could be processed and imaged. In addition, the IBM tool can fit on a tabletop, and the patterns can be tested as they are written for rapid prototyping.



To create the record-setting cover, IBM scientists invented a tiny “chisel” with a heatable silicon tip 100,000 times smaller than a sharpened pencil point. Using this nano-sized tip, which creates patterns and structures on a microscopic scale, it took scientists just 10 minutes and 40 seconds to etch the magazine cover onto a polymer, the same substance of which plastics are made. The resulting magazine cover measures 11 × 14 micrometers, which is so small that 2,000 could fit on a grain of salt.

Scientists envision applications in addition to transistors including nano-sized security tags to prevent the forgery of documents like currency, passports and priceless works of art and in the emerging field of quantum computing. One way to connect quantum systems is via electromagnetic radiation or light. The nano-sized tip could be used to create high-quality patterns to control and manipulate light at unprecedented precision.

IBM has licensed the "chiseling" technology to a start-up based in Switzerland called SwissLitho who are bringing the technology to market under the name NanoFrazor. Several weeks ago the firm shipped its first NanoFrazor to McGill University's Nanotools Microfab in Canada where scientists and students will use the tool's unique fabrication capabilities to experiment with ideas for designing novel nano-devices. To celebrate the tool's arrival the university created a nano-sized map of Canada measuring 30 micrometers or 0.030 millimeters in length.

Provided by IBM