

Research

HIGHLIGHTS

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AFOSR Lauded for
Scientific Program
Management,
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NU Professor Crosses Line to Faster Computer Circuits

AN ARTICLE PUBLISHED IN THE "CHICAGO SUN TIMES"
BY NEIL STEINBERG ON JANUARY 29, 1999

A tiny, tiny line drawn by a
whisp of a quill pen attached to
a computerized microscope at
Northwestern University might be the key
to development of faster computer circuits
and needle-tip sized medical probes in
the future.

"What we've done is miniaturized 4,000-year-old technology," said Chad A. Mirkin, the Morrison professor of Chemistry at Northwestern, whose research, aided by several students and post-doctoral candidate co-authors, is being published today in the journal *Science*.

The researchers — sponsored by the Air Force Office of Scientific Research and the National Science Foundation — made a small quill pen out of a tip of silicon nitride, then

used an atomic force microscope to guide the pen to produce the thinnest lines ever drawn: 15 nanometers — or billionths of a meter — wide. The smallest electronic circuits now in development are about 180 nanometers, and a fine human hair is about 10,000 nanometers thick.

The ink is first allowed to dry on the pen tip, then the tip is brought in contact with the surface — in this case, a gold mirrored foil.

"A small amount of water condenses in capillary from the tip to the surface," said Mirkin, 35. "The ink travels to the water, to the paper, which in this case is gold."

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AIR FORCE TO BENEFIT WITH SMALLER, LIGHTER, LESS COSTLY SYSTEMS

Invention of this novel tool, using dip-pen nanolithography (DPN) — which has created the world's smallest pen — will catalyze many advances in the emerging areas of nanotechnology and molecule-based electronics. This advance will enhance the possibility of future Air Force weapon systems becoming smaller, lighter, and less expensive.

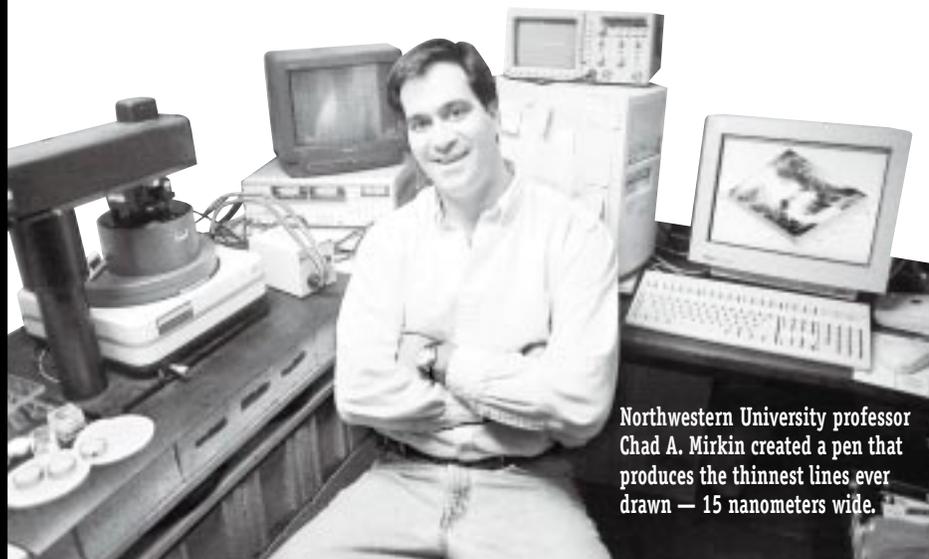
Specifically, DPN is the missing link in the nanotechnology arena that will allow development of smaller, lighter weight, faster, and more reliably produced:

- electronic circuits and devices,
- high-density storage materials, and
- sensory structures.

Use of the technology could possibly be used to create many small-scale sensors and power assemblies mounted on a single chip for use on micro-satellites or mounted within an Unmanned Aerospace Vehicle (UAV). The savings in launch weight provides for significant savings in launch costs.

Microelectronics have always been limited by the size of the components that make up a device. That limitation may now have been breached by the invention of a new tool for preparing molecule-based nanostructures. "Dip Pen Nanolithography" (DPN) was recently invented by Northwestern Researchers with the help of an AFOSR funding grant.

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Northwestern University professor Chad A. Mirkin created a pen that produces the thinnest lines ever drawn — 15 nanometers wide.