Scanning Scanning Electron Microscopy

Lee van Hook
Piltdown Research Institute, Munchausen University

Miniaturization of electronic components is now reaching the level of whole instruments, and not just parts like transistors. Thomas George recently reported on a tiny electron microscope column a "few millimeters thick and about a centimeter square", which would work in air. The secret being an electron-transparent membrane sealing in the column's vacuum. This is exciting news for folks working in areas such as acarid chaetotaxy that would benefit from a pocket-size electron microscope. However, it's limited by a micrometer-scale resolution limit.

Help is on the way, however. In separate reports in Applied Physics Letters, Driskill-Smith *et al.* published "The 'nano-triode:' A nanoscale field-emission tube", and Dean and Chalamala published "The environmental stability of field emission from single-walled carbon nanotubes."

Since, as everyone knows, an electron microscope's electron gun is a triode vacuum tube, the application is obvious. Everyone old enough to remember vacuum tubes, I should say. By modifying and further shrinking of George's tiny EM using the nanotriode of Driskill-Smith et al., and using Dean and Chalamala's carbon nanotube as the electron source, the size of electron microscopes can themselves reach the nanoscale level.

This would require placing the instrument very close to the specimen's surface, within a few nanometers. This is not a handicap, however, as there is a family of microscopes specifically for operation within nanometers or Angstroms of a specimen: the scanning probe microscopes. Since the tips for many of these microscopes are formed by microlithographic circuit-building methods, the techniques are in place for forming nanotriodes and detectors on the tip of a scanned probe microscope. This would place a field-emission scanning electron microscope within a few nanometers of a specimen's surface and allow it to be scanned over the specimen's surface, building a SEM image in the usual manner. The resulting Scanning Scanning Electron Microscope (SSEM) will provide nanometer-scale resolution, perhaps even Angstrom-scale, in a compact instrument at the fraction of the cost of today's field-emission SEMs, perhaps even under fluids. An added benefit would be that imaging by various non-contact modes of scanning probe microscopy could still be done, allowing the simultaneous acquisition of both SEM and SPM images.

Engineers at the PRI are feverishly working on fabricating this new generation of nanoscopes, which is expected to be accomplished shortly. As soon as they've feverishly fabricated the necessary tools and nanolithography methods.

Dean, K.A. and B.R. Chalamala. 1999. Applied Physics Letters. 75(18):3017-3019
Driskill-Smith, A.A.G., D.G. Hasko, and H. Ahmed. 1999. Applied Physics Letters. 75(18):2845-2847
George, T. 1998. NASA Tech Briefs, August: 25-26

More Instructions for the Production and Collection of Serial Sections

Robert Blystone, Trinity University
rblyston@trinity.edu

There was a spate of posts concerning the production and collection of ultrathin serial sections on the microscopy listserver, so I wanted to draw the microscopy community's attention to these instructions from an unfortunately obscure microscopy book. "To obtain quality serial sections for electron microscopy the following procedure must be followed for consistent results.

1) Obtain one male goat.
2) Wait for new moon after a rain storm.
3) Obtain black robes which have been treated with a Z-Stat™ gun.
4) Sacrifice goat in the light of the new moon.
5) Collect blood.
6) Spin down blood in centrifuge, collect goat plasma, and store at 4°C
7) Take piece of plastic from sample block to be cut. Pulverize into dust.
8) Mix plastic dust with goat plasma.
9) Inject plastic/goat into rabbit.
10) Wait one pay period.
11) Wait for the full moon.
12) Place black robes on which have been retreated with a Z-Stat™gun.
13) Sacrifice rabbit which has been injected with plastic/goat antigen under the full moon.
14) Collect antiplastic/goat antibody from rabbit.
15) Place one drop of antiplastic/goat antibody in the trough of diamond knife.
16) Cut serial sections.
17) The antiplastic antisera should cause all the plastic sections to arrange themselves in the proper order.
18) This should all make anti-sense."

"At the Knife's Edge" by Keith Blum, from an anthology titled "*Cafe Latta*" by Porter Sorvall.

Editor's Note

With the philosophy that a bit of humor is not necessarily a bad thing, the above two articles are presented.

In the future, on this page only, we would like to publish material relating to the lighted side of our lives- be they be in the form of articles, jokes or cartoons.

To this end, we would greatly appreciate contributions from our readers. The only criteria is that they must, vaguely at least, relate to our professional lives.

- - - Don Grimes, Editor