Some Thoughts On Vibrations In EM Laboratories

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Sometimes a scientist or laboratory manager has the opportunity to be involved in the design of a new building for housing sensitive instruments, such as electron microscopes. Unfortunately, few of us are trained in the necessary skills, and "learning the hard way", by making mistakes, is not really satisfactory, given the expected lifetime of the resulting structure. It has to "right first time"!

Vibration, sound and electromagnetic interference are all huge unknowns, when it comes to microscope performance. Each manufacturer will provide you with a set of specifications which are "required" for their instrument to meet its guaranteed performance criteria. A new lab should, ideally, be designed to be significantly better than those specs, because the lab will (hopefully!) outlast the instruments you buy now. Future instruments will, in all probability, have tighter specs than the present ones. Not only that, but not even the manufacturer KNOWS, for certain, that the instrument will work even in an environment that meets the specs.

This, by the way, is because the specifications are entirely empirical. There is no magic formula a manufacturer can use, plugging in various pieces of information about the microscope, which tells them the tolerable interference levels. They just pluck a figure from the air (well, based on the experience of *lots* of earlier installations, and their own lab instruments), and hope for the best. If your installation has difficulties, the next customer will find the specs tightened. Each site is slightly different, and can present some new twist of vibrational frequency, direction, or whatever, that can excite a previously unknown resonance in the microscope system. Alternatively, perhaps, your system may be subtly different from others (a new batch of wire for some of the springs in the stage, for example, changing the resonant frequencies), so it responds differently.

Some readers may not agree with my next comment, but in my experience, manufacturers will not abandon you if your site is a few percent out of spec - they will work with you, within reason, to get the instrument running well (it is bad publicity for them otherwise). The difference is that you may have to pay for extra amelioration, whereas if your site is in spec, they will (usually) pay.

Intuitively, a very solid setting, such as granite bedrock, would be thought to be a good site - after all, don't we try to put pilings down to bedrock to get stable sites in other areas. However, it can also transmit vibrations as well if any are induced. Sandstone, I am told, is much better, because it damps the vibrations much more. Any of them, I am certain, are better than the mud-filled salt marshes on which MIT is built (hence my opening remark!).

So where does that leave us, as users? Architects will ask you for the "Specifications" of the instruments you want to install, and will find the cheapest way of meeting them. In 1980, our EM site easily met the requirements for our EM300 and JEOL200CX. Surprise, surprise - it doesn't come close for a modern FEG-IVEM! On the other hand, given your location, is there much that can be done? Usually one tries to reach the bedrock, but it may be a case of what you have is all you can get. If there is too much vibration on your floor, you may have to live with what improvement an isolation system can provide (modern active ones are very effective). This is particularly true if the ground outside the building is subject to vibrations.

Get qualified, experienced engineers to perform your surveys. Your architects should have contact with people they have worked with in the past, and the microscope vendors certainly have such contacts. Don't forget acoustical interference, electromagnetic problems (magnetic fields, once generated, cannot be eliminated - only moved!). Ask for - nay, DEMAND - the best site money can buy. It will, in the long run, be a good investment for you lab.

By the way, very little of the above represents quality scientific research - just a lot of strongly held subjective opinions formed over the years. ■

COMING EVENTS

OPTICAL MICROSCOPY IN THE BIOLOGICAL SCIENCES

✓ June 5/12 '02: (Univ. of Texas Health Science Ctr), San Antonio, TX, Victoria Centonze Frohlich, frohlich@uthscsa.edu, www.uthscsa.edu/csb/image/Announcements.html

3D MICROSCOPY OF LIVING CELLS

✓ June 10/20: (& June 22/24: **Post- course Workshop**) Vancouver, BC, Canada. www.3dcourse.ubc.ca/home.html

2002 LEHIGH MICROSCOPY SCHOOL

✓ June 10/14: SEM and X-ray Microanalysis
✓ June 9: Introduction to SEM and EDS
✓ June 17/20: Advanced Scanning Electron Microscopy
✓ June 17/20: Quantitative X-ray Microanalysis
✓ June 17/20: Analytical Transmission Electron Microscopy
✓ June 18/21: Atomic Force Microscopy
✓ June 17/20: Characterization of Nanostructures

Lehigh Universtiy, Bethlehem, PA
For info: Sharon Coe, (610)758-5133, sharon.coe@lehigh.edu

QUANTITATIVE FLUORESCENCE MICROSCOPY

✓ June 16/21 '02: **Fourth Annual Course in Quantitative Fluorescence Microscopy** Arcadia National Park, Maine. Simon Watkins: (412)648-3051, swatkins+@pitt.edu

YEAR 2002 APPLIED OPTICAL MICROSCOPY CALENDAR Smithsonian Ctr for Materials Research & Educ. (Suitland, MD)

✓ July 8/12: Polarized Light Microscopy—Fundamentals and Applications.For further information: Ms. Francine Lewis: (301)238-3700 X102

YEAR 2002 MARINE BIOLOGICAL LAB, Woods Hole, MA.

✓ Oct 10/19 '02: Optical Microscopy & Imaging in the Biomedical Sciences, Carol Hamel, (508)289-7401, admissions@mbl.ed

SCANDEM 2002

✓ June 12-15, 2002 Tampere, Finland. www.scandem2002.tut.fi

MOLECULAR MICROSPECTROSCOPY

✓ June 24/27 '02: **17th Annual Short Course on Molecular Microspectroscopy** (Miami Univ.) Oxford, OH (513)529-2874, www. muohio.edu/mml

MICROSCIENCE

✓ July 9/11 '02: London, UK, Info@rms.org.uk, www.rms.org.uk/microscience2002

MICROSCOPY & MICROANALYSIS 2002

✓ August 4/9 '02: (MSA/MAS/IMS) Quebec City, Canada. Http: www.msa.microscopy.com

CONFERENCE ON NEAR FIELD OPTICS

✓ August 11-15 '02 7th International conference on Near Field Optics and Related Techniques, Rochester, NY www.optics.rochester.edu:8080/workgroups/novotny/nfo7.html

UltraPath XI

✓ August 12/16 '02: (Society for Ultrastructural Pathology) Aspen, CO, Gary Mierau: (303)861-6170, mierau.gary@tchden.org

ICEM-15

✓ September 1/6 '02: **15th International Congress on Electron Microscopy (ICEM-15).** Durban, South Africa. www.icem15.com

CELL BIOLOGY?

✓ December 14-18, '02, The American Society for Cell Biology, San Francisco, CA., www.ascb.org