MICROSCOPY IN THE REAL WORLD: A MANUFACTURER'S PERSPECTIVE

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What in the "real" world does this title mean? Of course, every one using an instrument will insist that his application is in some way unique and therefore not a common, mundane, "real-world" one. The "real-world" for an academically motivated scientist may be quite different from the "real-world" of the commercially motivated scientist. What happens in an asbestos testing lab is quite different from the activities of a consulting group using the microscope to solve industrial problems. Every application is "real world"...but they most certainly may be different.

And so, where to begin? For a start, consider the following "real world" situations: I. a University using a microscope to support the research activities of that University, 2. a biotech application in a pharmaceutical laboratory studying the variables of drug delivery, 3. a consulting lab studying the effects of defects in an optical fiber transmission system, 4. a basic science laboratory involved in microstructural characterization of new high temperature materials, 5. an industrial laboratory policing manufacturing processes from competitors to ensure there is no patent infringement, 6. a hospital using the microscope to diagnose kidney disorders, 7. a teaching laboratory in a major University... is there an end to this list? The fact is, there is enormous variety in the Real World, but there are common elements too. First the variety: Defining the specification is a reasonable way to begin. Using the above examples as a guideline, a very basic specification for each application can be generated. They are all different, of course. In the first case, a University using a microscope to support the research activities of that University, the specification is high performance, ease of use, and versatility. If a materials science application, the high performance will have a different definition than if the application is in biological science. For example, high contrast and high resolution are opposite requirements. If the predominant application is biological, a long focal length will be more desirable than a short one and the point resolution will suffer. The gap must be large and the objective aperture must be as close to the back focal plane as possible. If a materials application, the Cs should be small, the polepiece gap will be small, and the focal length will be short. In fact, the focal length as a parameter has little relevance in materials applications. In the second case, the pharmaceutical laboratory, the specification would likely be good high contrast with good resolution (the performance — a compromise), ease of use (to ensure effective utilization of the technical staff), and extremely reliable operation. Versatility is not required since the application is relatively focused. If for a single researcher, ease of use may not be a major concern, but certainly difficult to use would not be acceptable either. In the third case, a consulting laboratory studying defects optical fiber defects, the specification would be high performance (small probes/good diffraction capability/advanced analytical performance), integration of functions, and extremely reliable operation. A commercially operated instrument has to pay for itself. It also has to have the proper price/performance ratio. In the fourth case, a basic science laboratory involved in microstructural characterization of new high temperature materials, the instrument would need high resolution, moderate tilt, analytical variety (small probes for EDS, EELS (and microdiffraction), high kV, and a hot stage. Ease of use would be essential since many analytical functions would be required. An integrated system would also be helpful to reduce the time required for each analysis. And so on... Some applications require tilt, some high resolution, some high contrast, some need film, some no film, some analytical, some stage accuracy, some good high magnification, some good low magnification, some need energy filtering, some need secondary imaging, some STEM HAADF imaging, some remote control imaging, some full integration of functions for basic users, some automation of functions, etc. *ad nauseam*. Somewhere in all this horse merde must be a horse since there are so many applications, so many specifications.

The horse is the basic technology on which the microscope is based. The basic specifications of all microscopes can easily be written. They are: I. A high level of stability in all thermal, mechanical, and electrical components, 2. a clean, high vacuum, 3. well made optics, and 4. a control system that keeps the microscope aligned under all the many conditions for which the microscope is designed. A 5th and rather nebulous specification is ease of servicing and general design. Reliability is a given. The first specification will ensure drift free imaging, reproducible focus and resolution, probe stability for analytical applications, and stable high voltage: the second, lack of contamination (a different term if a cryo-biologist or a materials scientist): the third, high resolution or high contrast, and numerous probe and convergence conditions: the fourth, an easy to use microscope.

Assuming that this instrument already exists and that this approach has been followed since microscopes were first invented, why does the perfect instrument not exist today?... and assuming that it doesn't (a safe assumption), what can a manufacturer do to improve the user's situation in the "real world"? Instruments today are quite satisfactory in stability, contamination (lack of), and optics. The advantages to be offered to users today (in addition to new and exotic electron optical approaches) are primarily offering instrumentation that is greatly simplified and automated, that is, instrumentation that will allow non-sophisticated users to successfully use a Transmission Electron Microscope, to allow simplified platforms for integration of analytical and imaging functions, to allow more automation (focussing, stigmation), and to offer services to users through a network (TEM.com?) that have heretofore not been available.

These advantages are offered today through the integration of microscopes due to the convergence of software languages. EDS companies, GATAN, EMISPEC, and others now using a common language platform that, provided the microscope uses a similar platform, allows the microscope to be easily integrated with the various capabilities of this other software. If integration is done properly, it is even possible to control the microscope remotely as though the user were present at the instrument. A service engineer, applications specialist, or trainer can log on to an instrument and perform required functions without having to be physically at the microscope. This should be very comforting to both novice user and a boon to the user who needs some advice and help but does not need physical presence. Of course, the manufacturers like this approach too since it will reduce service calls (a reduction in the price of the service contract?), improve user capability through remote troubleshooting and training, and assist a user who wants to try a sophisticated application but hasn't the experience to try it himself. Remote imaging will also be important to the user should he wish to improve the utilization of his instrument through multiple outside users. Computers, not microscopes, are the future... the "real world". We knew it all along. ■

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New And/Or Interesting in Microscopy at PITTCON 2002

As is our custom, we provide the following microscopy-related, Directory of Exhibitors at the recent PITTCON conference in New Orleans. The short summaries provided were obtained either from the exhibitors or were copied, with the exhibitorís permission, from PITTCON handouts.

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