

Specifications for a Scanning Auger Microprobe Analyzer

I. Technical Requirements

NRL requires an hemispherical electron spectrometer for Auger Electron Spectroscopy (AES), and Scanning Auger Microscopy (SAM) applications. The instrument must be spatially, electronically, magnetically and vibrationally compatible with an ultrahigh vacuum ($<6 \times 10^{-11}$ Torr), high resolution scanning electron microscope the Omicron Gemini, possessing 6 nm resolution at a 15 mm working distance and 15 keV beam energy, with an Omicron variable-temperature Nanoprobe multitype STM station and with sample holders of the type used in the Nanoprobe and an additional associated Omicron variable temperature STM/AFM. Spatial compatibility denotes that the analyzer, SEM and Nanoprobe units all fit onto one UHV chamber, while permitting unencumbered analytical access to samples for each unit without the need to move the samples. Electronic, vibrational and magnetic compatibility denotes that neither the SEM nor the Nanoprobe suffer a performance reduction due to the presence of the analyzer and vice versa. The Variable Temperature STM/AFM resides in a different, interconnected UHV chamber, but the sample mount and transfer system must be compatible with the SEM/Nanoprobe/SAM analyzer combination as well as the Variable Temperature STM/AFM.

II. Performance

The analyzer must have >70 Mcps integral count rate and an energy resolution of $\Delta E/E < 0.5\%$.

III. UHV Hardware

The instrument must be spatially, electronically, magnetically and vibrationally compatible with the ultrahigh vacuum ($<6 \times 10^{-11}$ Torr) Omicron Nanoprobe apparatus and the high-resolution SEM, and be bakeable to at least 180 °C.

IV. SAM Hardware

The analyzer lens must be shaped to have a wide acceptance angle which can collect electrons at an optimal working distance of approximately 22 mm and designed to maximize performance from the specific SEM objective lens system. The electron deflection unit must consist of double octopole deflectors for compensation of the errors introduced by magnetic and electrostatic fields from the other system components. The analyzer must have seven-channel or more pulse counting detection with >70 Mcps integral count rate, and a variable slit mechanism for optimization of the resolution and a broad range of pass energies to allow appropriate compromises between intensity and resolution.

V. Sample and Probe holders

As noted above, the sample holder must be compatible with the scanning electron microscope, Omicron Nanoprobe and Omicron Variable Temperature AFM/STM stations.

VI. Sample/Probe Viewing

The SAM analyzer must permit visual access to the samples from outside the chamber when the samples are in position for SAM, SEM, or STM with the Nanoprobe. The analyzer must not prevent or hinder sample imaging by the SEM or STM.

VII. Electronics and Software

The electronics and software of the SAM analyzer and the SEM to allow for simultaneous control of the analyzer and electron beam during the measurement process.

VIII. Computer System

The SAM must be interfaced and controllable by the computer system used to control the scanning electron microscope. Thus, the computer must contain software capable of controlling both the SEM and the SAM analyzer. The SAM software must control the operation of the analyzer, including Auger data acquisition in point, line and map modes, and associated Auger data processing, e.g. composition and peak assignment. The computer system is not a part of this procurement. The specifications for the existing computer system are as follows:

1.6 GHz personal computer, minimum hardware configuration: 256 Meg RAM, 40 GB hard drive, 1.44 MB floppy drive, CD-RW drive, USB 250 MB Zip drive or equivalent, keyboard, mouse, and Ethernet, Windows NT, Windows 2000, or Windows XP operating system and control drivers installed, 21" or larger color monitor, Windows NT-based software for operation of column and source, SEM image acquisition, image processing and data filing.

IX. Miscellaneous

- 1) User Manuals including schematics and block diagrams
- 2) 2-year software upgrade subscription
- 3) On-site installation
- 4) On-site training