



Standard Practice for Reporting Imaging Data in Secondary Ion Mass Spectrometry (SIMS)¹

This standard is issued under the fixed designation E 1635; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice lists the minimum information necessary to describe the instrumental, experimental, and data reduction procedures used in acquiring and reporting images generated by secondary ion mass spectrometry (SIMS).

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

E 673 Terminology Relating to Surface Analysis²

E 1504 Practice for Reporting Mass Spectral Data in Secondary Ion Mass Spectrometry (SIMS)²

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminology E 673.

4. Summary of Practice

4.1 Experimental conditions and reporting procedures that affect SIMS imaging data are presented in order to standardize the reporting of such data and to facilitate comparisons with other laboratories and analytical techniques.

5. Significance and Use

5.1 This practice is to be used for reporting the experimental and data reduction procedures to be described with the publication of the data.

6. Information to be Reported

6.1 Standard information to be reported may be found in Practice E 1504. This information pertains to the type of SIMS instrumentation used, the mounting of the specimen, and the experimental conditions. For imaging SIMS analysis, additional information is required on the acquisition and display parameters for each image. The information reported will

depend primarily on the type of SIMS instrumentation used. Two distinct instrumental configurations are used for ion imaging: the ion microscope and the ion microprobe.

6.2 *Experimental Conditions for Acquisition of Ion Microscope Images:*

6.2.1 *Camera Based Systems*—In the ion microscope, the secondary ion optics project a mass resolved secondary ion image onto the plane of an imaging detector. In the simplest case, the secondary ion image is visualized via ion-to-electron conversion at a channel plate array placed in front of a fluorescent screen.³ The image resolution depends on the setup of the ion optics and the energy and angular distribution of the sputtered ion flux and is typically 0.5 to 1 μm. The ion image is visualized on the fluorescent screen using a variety of camera systems, including but not limited to vidicon cameras, intensified cameras such as the SIT camera, charge-coupled device (CCD) cameras and slow-scan scientific grade CCD cameras. The type of camera system used will define the sensitivity and dynamic range of the acquired images. Minimum parameters to be specified should include the integration time for each mass, number of pixels in the image, field-of-view, and the level of digitization (one byte or two). Also, the type of channel plate used for ion-to-electron conversion should be stated (single, double, curved, or high-output-technology (HOT) plates). The setup of the secondary ion optics should be reported, including the use and settings of contrast apertures, energy resolving slits, and high mass resolution. Any information pertinent to the specific operation of a given type of camera or image acquisition system should also be included. This could include manufacturer and model number and the use of any accessory or auxiliary equipment that would affect the acquisition or display of an image. If long integration times are used, a dark-current image (or detail about the maximum intensity/pixel in dark-current mode) should be included. Any nonstandard modifications made to the equipment should be described in detail.

6.2.2 *Resistive Anode Encoder Systems*—The resistive anode encoder (RAE) is a position-sensitive, pulse-counting detector that replaces the standard channel plate/fluorescent screen assembly.⁴ The RAE assembly consists of a double

¹ This practice is under the jurisdiction of ASTM Committee E-42 on Surface Analysis and is the direct responsibility of Subcommittee E42.06 on SIMS.

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² *Annual Book of ASTM Standards*, Vol 03.06.

³ Lapareur, M., *Rev. Tech. Thomson-CSF 12(1)*, p. 225, 1980.

⁴ Odom, R. W., Furman, B. K., Evans, C. A., Bryson, C. E., Peterson, W. A., Kelly, M. A., and Wayne, D. H., *Analytical Chemistry*, Vol 55, p. 574, 1983.