



Standard Practice for Testing the Performance of Scanning Raman Spectrometers¹

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1. Scope

1.1 This practice is designed for routine testing of scanning Raman spectrometer performance and to assist in locating problems when performance has degraded. It is also intended as a guide for obtaining and reporting Raman spectra.

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.* For specific precautions, see 7.2.1.

1.3 Because of the significant dangers associated with the use of lasers, ANSI Z136.1 should be followed in conjunction with this practice.

2. Referenced Documents

2.1 ASTM Standards:

E 131 Terminology Relating to Molecular Spectroscopy²

E 1840 Guide for Raman Shift Standards for Spectrometer Calibration²

2.2 ANSI Standard:

Z136.1 Safe Use of Lasers³

3. Terminology

3.1 Terminology used in this practice conforms to the definitions in Terminology E 131.

4. Significance and Use

4.1 A scanning Raman spectrometer should be checked regularly to determine if its condition is adequate for routine measurements or if it has changed. This practice is designed to facilitate that determination and, if performance is unsatisfactory, to identify the part of the system that needs attention. These tests apply for single-, double-, or triplemonochromator scanning Raman instruments commercially available. They do

not apply for multichannel or Fourier transform instruments, or for gated integrator systems requiring a pulsed laser source. Use of this practice is intended only for trained optical spectroscopists and should be used in conjunction with standard texts.

5. Apparatus

5.1 *Laser*—A monochromatic, continuous laser source, such as an argon, krypton, or helium-neon laser, is normally used for Raman measurements. The laser intensity should be measured at the sample with a power meter because optical components between the laser and sample reduce laser intensity. A filtering device should also be used to remove non-lasting plasma emission lines from the laser beam before they reach the sample. Plasma lines can seriously interfere with Raman measurements. Filtering devices include dispersive monochromators and interference filters.

5.2 *Sampling Optics*—Commercial instruments can be purchased with sampling optics to focus the laser beam onto a sample and to image the Raman scattering onto the monochromator entrance slit. Sample chamber adjustments are used to center the sample properly and align the Raman scattered light. A schematic view of a conventional 90° Raman scattering geometry is shown in Fig. 1. The laser beam propagates at a right angle to the direction in which scattered light is collected. It is focused on the sample at the same position as the monochromator entrance slit image. Other geometries such as 180° backscattering are also used. With single monochromators, a filter is normally placed in the optical collection path to block light at the laser frequency from entering the monochromator.

5.3 *Polarization*—For routine measurements the polarization of the laser at the sample is oriented normal to the plane of the page in Fig. 1. However, measurements using different polarizations are sometimes used to determine vibrational symmetries as part of molecular structure determinations. A variety of optical configurations can be used to make polarization measurements; a detailed discussion of these is beyond the scope of this practice. Briefly, for polarization simple measurements of randomly-oriented samples (most of the clear liquids), an analyzing element such as a polaroid filter or analyzing prism is added to the optical system and Raman

¹ This practice is under the jurisdiction of ASTM Committee E13 on Molecular Spectroscopy and is the direct responsibility of Subcommittee E13.08 on Raman Spectroscopy.

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

³ Available from American National Standards Institute, 25W. 43rd Street, 4th Floor, New York, NY 10036.