



Standard Practice for General Techniques of Thermogravimetric Analysis (TGA) Coupled With Infrared Analysis (TGA/IR)¹

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1. Scope

1.1 This practice covers techniques that are of general use in the qualitative analysis of samples by thermogravimetric analysis (TGA) coupled with infrared (IR) spectrometric techniques. The combination of these techniques is often referred to as TGA/IR.

1.2 A sample heated in a TGA furnace using a predetermined temperature profile typically undergoes one or more weight losses. Materials evolved during these weight losses are then analyzed using infrared spectroscopy to determine chemical identity. The analysis may involve collecting discrete evolved gas samples or, more commonly, may involve passing the evolved gas through a heated flowcell during the TGA experiment. The general techniques of TGA/IR and other corresponding techniques, such as TGA coupled with mass spectroscopy (TGA/MS), as well as, TGA, used in conjunction with GC/IR, are described in the referenced literature (1-4).²

1.3 Some thermal analysis instruments are designed to perform both thermogravimetric analysis and differential scanning calorimetry simultaneously. This type of instrument is sometimes called a simultaneous thermal analyzer (STA). The evolved gas analysis performed with an STA instrument (5) is similar to that with a TGA, and so, would be covered by this practice. With use of a simultaneous thermal analyzer, the coupled method typically is labeled STA/IR.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This statement 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.*

¹ This practice is under the jurisdiction of ASTM Committee E13 on Molecular Spectroscopy and Separation Science and is the direct responsibility of Subcommittee E13.03 on Infrared and Near Infrared Spectroscopy.

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² The boldface numbers in parentheses refer to a list of references at the end of this standard.

2. Referenced Documents

2.1 ASTM Standards:³

- E131 Terminology Relating to Molecular Spectroscopy
- E168 Practices for General Techniques of Infrared Quantitative Analysis
- E334 Practice for General Techniques of Infrared Microanalysis
- E473 Terminology Relating to Thermal Analysis and Rheology
- E1131 Test Method for Compositional Analysis by Thermogravimetry
- E1252 Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis
- E1421 Practice for Describing and Measuring Performance of Fourier Transform Mid-Infrared (FT-MIR) Spectrometers: Level Zero and Level One Tests

3. Terminology

3.1 *Definitions*—For general definitions of terms and symbols, refer to Terminologies E131 and E473.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *evolved gas, n*—any material (or mixture) evolved from a sample during a thermogravimetric or simultaneous thermal analysis experiment. Materials evolved from the sample may be in the form of a gas, a vapor, an aerosol or as particulate matter. For brevity, the term “evolved gas” will be used throughout this practice to indicate any material form or mixture evolved from a sample.

3.2.2 *evolved gas analysis (EGA), n*—a technique in which the nature and amount of gas evolved from a sample is monitored against time or temperature during a programmed change in temperature of the sample.

3.2.3 *evolved gas profile (EGP), n*—an indication of the total amount of gases evolved, as a function of time or temperature, during the thermogravimetric experiment. In TGA/IR, this profile is calculated from the infrared spectroscopic data recorded by application of the Gram-Schmidt

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.