

100% Line: the ratio of two single beam spectra recorded under identical conditions. Ideally, the result is a flat line at 100% transmittance. The slope and noise of 100% lines are measured to determine the instrument stability and noise level.

Absorbance: The fraction of the incident radiation that is neither reflected nor transmitted by the sample. This term is also commonly, although incorrectly, used for $\log(1/\text{Transmittance})$.

Absorbance Spectrum: a graph showing $A = \log(1/T)$, as a function of either wavelength or frequency.

Alignment: the adjustment of optical components, such as mirrors and lenses, to bring all of their optical axes in line to maximize performance.

Analyte: the substance of interest when performing a quantitative analysis.

Angle of Incidence: the angle at which radiation strikes a surface; measured from the normal to the surface.

Aperture: an opening in an optical system.

ATR (Attenuated Total Reflectance): a spectroscopic technique based on the measurement of the supercritical internal reflectance of a sample-ATR crystal interface.

Baseline Correction: a spectral manipulation used to correct spectra with sloped or curved baselines; generally accomplished by subtracting from the spectrum a function drawn parallel to the baseline.

Beamsplitter: a device used to produce two separate beams from one incident beam; generally a prism, window, or half-silvered mirror that reflects and transmits approximately equal portions of the incident radiation.

Beer-Lambert Law: linear approximation for the relation between the absorbance of a sample and its concentration used to predict unknown concentrations; mathematically, expressed by $A = abc$ where A represents absorbance, a , b , and c are absorptivity or extinction coefficient, pathlength and concentration, respectively. Also known as the Bouguer law.

Birefringence: the separation of a ray of light into two unequally refracted, polarized rays, occurring in crystals in which the velocity of light rays is not the same in all directions; numerically quantified as the difference between the greater and lesser refractive indices of the anisotropic crystal. Also called double refraction.

Calibration: the process in quantitative analysis by which the peak heights and areas in a spectrum are correlated with the concentrations of the analyte in standards. After calibration, the concentration of the analyte in unknown samples can be predicted.

Calibration Curve: a plot of absorbance versus concentration used in calibration. The graph is often non-linear demonstrating the approximate nature of Beer's law.

Coadding: the process of adding measured spectra together to achieve an improvement in the signal-to-noise ratio.

Condenser: an optical element that gathers and concentrates light in a specific location.

Critical Angle: the smallest angle of incidence at which total internal reflection occurs; $q_c = \sin^{-1}(n_2/n_1)$, where n_2 and n_1 are the refractive indices of two materials at the interface and n_2 has the higher refractive material.

Depth of Penetration: a measure of how far radiation penetrates into the sample in an ATR experiment; calculated as the depth at which the electric field of the evanescent wave has decreased to 37% of its original value. Parameters that affect the depth of penetration include the wavelength of the incident radiation, the refractive index of the ATR crystal, and the angle of incidence.

Diamond Anvil Cell: a transmission sample preparation device used to compress samples between two flat diamond surfaces. The cell is usually placed in a beam condenser or infrared microscope for analysis.

Diffraction: bending of wave, i.e. light and sound, around obstacles in their path. Diffraction effects are common in microscope systems where apertures are used to help measure very small samples.

Diffuse Reflectance: the scattering of light at all angles from a point of reflection. Diffuse reflection techniques are used to analyze rough-surfaced solid samples.

Dispersive Instruments: spectrophotometers that use gratings or prisms to disperse radiation into its component wavelengths prior to detection. This instrument dominated infrared spectroscopy before the development of FT-IR and continues to be used extensively in UV-VIS spectroscopy.

DRIFTS: an abbreviation for Diffuse Reflectance Fourier Transform Infrared Spectroscopy, the sampling technique that measures the diffuse reflectance in order to analyze powders and other solid samples.

Epitaxial Layer: a grown crystal layer with the same crystallographic orientation as the substrate crystal wafer. Also called epi.

EPI: abbreviation for an epitaxial layer.

Evanescent Wave: the wave generated in supercritical internal reflection above the totally reflecting surface of the ATR crystal. This wave extends beyond the crystal surface into a sample brought into contact with the surface resulting in the ability to obtain spectrum of the sample.

Far IR: infrared radiation between 400 and 10 cm^{-1} .

Fourier Transform: the mathematical transformation used in FT spectroscopy to convert an interferogram into an infrared spectrum.

Fourier Transform Infrared Spectroscopy (FTIR): a method of obtaining infrared spectra of a sample using an interferometer and then performing a Fourier transform on the resulting interferogram to extract the spectrum.

Grazing Angle: a high incident angle, typically 75° or greater.

Grazing Angle Reflection: reflection at a grazing incident angle. Grazing angle reflectance measurements are mostly used for analyzing sub-micron thick films deposited on reflective substrates.

Index of Refraction: the ratio of the speed of light in a vacuum to the speed of light in the medium under consideration. Also called refractive index.

Infrared Radiation: the portion of the electromagnetic spectrum from 10 to 14,000 cm^{-1} ; heat.

Infrared Spectrometer: an instrument used to obtain the infrared spectrum of a sample. It contains a source of infrared radiation, a sample compartment to allow the radiation to interact with a sample, a detector of radiation and means of determining and displaying the intensity of radiation as a function of wavenumber.

Infrared Spectroscopy: the study of the interaction of infrared radiation with matter.

Infrared Spectrum: a plot of measured infrared intensity versus wavenumber or wavelength used to determine molecular structure. The features in an infrared spectrum correlate with the presence of functional groups of molecules of a sample.

Interferogram: a plot of detector response as a function of optical path length difference.

Interferometer: a device used to measure an interferogram; typically an optical device that causes a radiation beam to split into two beams, recombines them after they traveled different distances (optical path difference) and measures the detector response as a function of optical path length difference.

Internal Reflection: the phenomenon where light passing through a material of high refractive index reflects off the interface with a material of a lower refractive index. Internal reflection can be subcritical (angle of incidence is smaller than critical) or supercritical (angle of incidence is larger than critical).

KBr Pellet: a pellet prepared by grinding the sample, diluting it in the KBr, and then pressing it into a transparent disc. This pellet is placed directly in the infrared beam for analysis.

Kramers-Kronig Transform: a transform used for extracting the complex refractive index of the sample from normal incidence reflection spectra of opaque samples.

Kubelka-Munk Function: a mathematical expression used in diffuse reflectance to relate the reflectance of a diluted sample of "infinite depth" to sample concentration; mathematically, $f(R_{\infty}) = (1-R_{\infty})^2 / (2 R_{\infty}) = 2.303ac/s$ where R_{∞} is the reflectance, a is absorptivity, c is the concentration, and s is a scattering coefficient. The scattering, shape, and packing density of the sample.

Kubelka-Munk Units: the peak intensity measure that results from the Kubelka-Munk transform of a diffuse reflection spectrum.

Micrometer(mm): 10^{-6} of a meter; a micron.

Mid-Infrared: infrared radiation between 400 and 4000 cm^{-1} .

Mull: a transmission sampling technique where the sample is ground, then dispersed in an oil or mulling agent. The mixture is then sandwiched between two KBr windows and placed in the infrared beam for analysis.

Mulling Agent/Mulling Oil: an oil that is added to a ground sample for the preparation of mulls.

Near IR: Infrared radiation between 14,000 and 4,000 cm^{-1} .

Nujol: refined mineral oil used for preparation of mulls.

Peak-to-Peak Noise: a noise measurement often made on the 100% line to determine spectrum quality and instrument performance; measured as the difference between the lowest and highest transmittance value in a specific wavenumber range.

Photoacoustic Spectroscopy (PAS): a sampling technique that collects an infrared spectrum by detecting the sound made when a sample absorbs the infrared radiation modulated by an interferometer. This technique can be used for quantitative analysis and depth profiling.

Polarizer: a device that only transmits photons with electric fields in a particular orientation.

Quantitative Analysis: calculations from measured spectra of concentrations of various compounds in a sample.

Raman Effect: an inelastic collision between an incident photon and a molecule where, as a result of the collision, the vibrational or rotational energy of the molecule is changed and thus the energy of the scattered photon differs from the energy of the incident photon.

Raman Spectroscopy: a spectroscopic method that utilizes the Raman effect to extract information about the vibrational structure of a molecule; a complementary technique to infrared spectroscopy that can reveal vibrations that are infrared-inactive.

Reflection-Absorption: a sampling technique used on thin films coated on reflective substrates. The impinging radiation passes through a film, reflects off a substrate, and passes through the film a second time before reaching the detector. This technique is also known as "double transmission".

Refractive Index: A mathematical description of the intrinsic properties of a material that govern its interaction with electromagnetic radiation; usually represented by a real part (n), the refractive index, and an imaginary part (k), the absorption index.

Resolution: a measure of how well a spectrometer can distinguish spectral features that are close together; resolution in FT-IR is determined by the maximum optical path difference reached in the measurement of an interferogram.

Reststrahlen: literally "leftover rays" in German. Reflectance for most samples is generally less than 10% but becomes large at a frequency of strongly absorbing bands. Thus if multiple specular reflection is used to analyze a sample, only radiation at frequencies of strongly absorbing bands remains-hence the name reststrahlen. Sample dilution can be used to reduce anomalous effects due to "reststrahlen" in diffuse reflection spectroscopy.

Sampling Depth: in photoacoustic spectroscopy, the depth in the sample from which 63% of the photoacoustic signal is measured.

Scan: the process of measuring an interferogram with an FTIR. Typically, this involves moving the mirror in the interferometer back and forth once.

Signal-to-Noise Ratio (SNR): a measurement of the quality of a spectrum, often employed to determine the quality of the spectrometer; the ratio of the signal, measured as a ratio the intensity of an absorbance band, to the RMS of the spectrum due to noise measured at a nearby point in the baseline.

Single Beam Spectrum: the spectrum obtained after Fourier transforming an interferogram; single beam spectra contain features due to the instrument, the environment and the sample, if present. Substrate: the material that supports sample.

Transmission: a physical phenomenon in which radiant energy passes directly through a sample. A portion of the energy is absorbed by the sample, another portion reflects from the sample, and the remainder is passed onto the detector.

Transmittance: a fraction of infrared radiation that passes through a sample.

Wavelength: the distance between adjacent crests or troughs of a light wave.

Wavenumber: the reciprocal of wavelength; usually expressed in cm^{-1} . Sometimes also referred as spatial frequency.