UV-Vis-NIR and Fluorescence Spectroscopy

Principle

UV-Vis Spectroscopy It allows to characterize the absorption or reflection of a material in the ultraviolet (UV) and visible light (Vis) regions of the electromagnetic spectrum. The energy provided by the incident light induces an electronic transition in molecules including chromophores (e.g. double or triple bonds, unpaired electrons, d orbitals, etc..), which can be monitored in an absorption spectrum.

Absorbance/Transmittance spectra. Colored solutions typically absorb in the visible region (400-750 nm), whereas colorless chemicals containing suitable chromophores may absorb in the UV region (200-400 nm). Through the Lambert-Beer law, the absorbance is linearly proportional to the molar concentration of the chromophores. Using calibration curves is often possible to obtain the concentration of the sample from absorption spectra.

Reflectance spectra. These measurements are usually performed on solid (opaque) samples, since light cannot penetrate them. On such samples, incident light is reflected on the surface and can be either reflected symmetrically with respect to the normal line (*specular reflection*), or scattered in different directions (*diffuse reflection*). The sum of both is called *total reflection*.

Near InfraRed (NIR) Spectroscopy Even if it is usually performed with a UV-Vis-NIR spectrometer, it is an infrared spectroscopy technique, which allows to characterize the electromagnetic region from 780 to 2500 nm.I NIR spectra,in specific contests, can be used for film thickness measurements, for chemical characterization of coatings/substrates for optoelectronic applications, and sometimes also for water content monitoring.

Fluorescence Spectroscopy is complementary to absorption spectroscopy and investigates the long-term average fluorescence of a sample when irradiated with UV-Vis light. The fluorescence spectrum is a plot of fluorescence intensity vs excitation wavelength. Such a spectrum allows the determination of the presence of fluorophores and their concentrations.

Capabilities

UV-Vis-NIR typical analyses are:

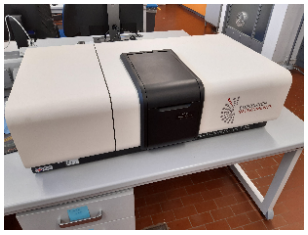
- Lambda max (wavelength of peak absorbance)
- Determination of concentrations of chromophores
- Absorbance (% Abs) or Transmittance (%T) of solutions over a selected wavelength range
- Transmittance (%T) and total and/or diffuse reflectance (%R) of solid samples (films, thin plates or powders) in UV-VIS-NIR range (with or without the integrating sphere).
- Film thickness measurements.
- Evaluation of visible light transmittance and solar transmittance
- Evaluation of optical properties of mirrors, reflective substrates, lens, etc.

Fluorescence typical analysis on solution samples or films are:

- Excitation Scans (emission set to a wavelength of known fluorescence emission by the sample, the intensity of fluorescence is scanned across the desired excitation range).
- Emission Scans (excitation set to a wavelength of known absorption by the sample, the intensity of fluorescence is scanned across the desired emission range).
- Synchronous Scans & Maps (excitation and emission monochromators scan at the same time with a fixed wavelength offset). This type of scan is used to identify species with a strong overlap between absorption and emission.
- Steady State Fluorescence Anisotropy
- Excitation-Emission Maps (EEMs)

Assets

	Asset	Details
	SHIMADZU UV-Vis-NIR UV-3600 Spectrophotometer	Spectral range: • Principal unit: from 190 to 3400 nm • Detection through integrating sphere: from 240 to 2400 nm Accessories: • integrating sphere • rotating film holder • specular reflectance (5° incident angle) accessory • large polarizer set (range 260 to 2300 nm)

	Edinburgh Instruments FS5 Spectrofluorometer	Spectral range: • excitation range: from 230 to 1000 nm • emission range: from 200 to 870 nm Accessories: • liquid cell holder • rotating film holder

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