Research Paper

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UV- VIS- NIR Spectrophotometer for Nano Particles and Nano- Crystalline Thin Films

Science

KEYWORDS : Absorbance, Transmittance, Absorbance, optical length, sample concentration, Beer's Law, scanning monochromatic light

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ABSTRACT

Thin films and nanoparticles now occupy a prominent place in basic research and solid state technology. Semiconductor nanoparticles have been extensively investigated during the last two decade, due to their properties and application. So the properties of the nano particles must be necessary to know from different techniques. For nanoparticles, the size and surface effect both are important. So ultraviolate, visible, near infrared spectrophotometer is helpful in Nano technology.

INTRODUCTION:

In UV-VIS-NIR spectrophotometer, radiation with particular wavelength incident on the sample, then there may be absorption and transmittance. From these two phenomenon, we can study the characterize of sample.

Basic principle of UV- VIS-NIR spectrophotometer:

A spectrophotometer is an instrument which measures the reflection or absorbance characteristics of a sample. The design of the instrument in such a way that the wavelength of the radiation to be studied must be a narrow "Window" so the wavelength of the ultraviolate (UV), visible (VIS) and near infrared (NIR) must be predefined.

If the definite wavelength is incident on the material, then there may be absorption of radiation and other wavelengths are not absorbed. So these absorbance phenomenons detect some important features of the material [1].

Light is made of photons. When this light is incident on the material, energy of the photon is transferred into material. But this is possible only when the energy levels of the photon is equal to the transition energy of the material. Light of certain wavelength incident on the material, then some light is transmitted, these transmitted light is detected by photo detector. A photo detector registers the absorbance of the sample.

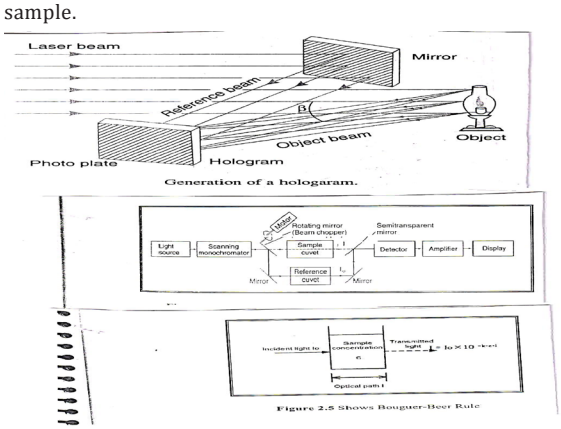


Figure 2.5 Shows Bouguer-Beer Rule

Transmittance is defined as the ratio of intensity of transmitted light. I is the intensity of incident light Io. ∴ Transmittance (T) =

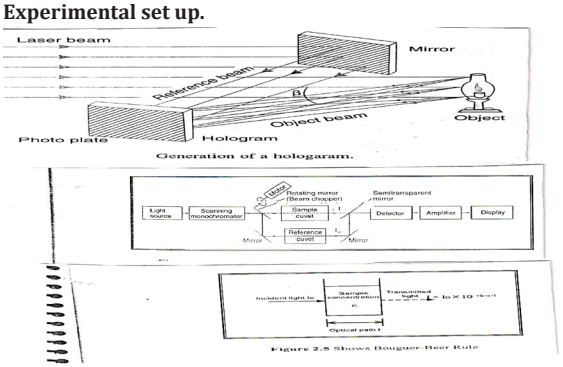
Transmittance rate is the percentile of Transmittance
∴ Transmittance rate (T %) = x100

Absorbance is defined as The Logarithm of inverse of Transmittance.

∴ Absorbance (Abs) = Log ( )
= Log ( )
From fig I= Io 10- kcl
Where l = optical Length
c = sample concentration
∴ = 10 kcl
∴ Log ( ) = kcl
∴ Abs = kcl

From above formulas, transmittance is not proportional to sample concentration. But Beer's Law, indicate that absorbance is proportional to sample concentration [2].

Experimental set up.



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Three main parts of the spectrophotometer (1) light source (2) a holder for the sample (3) scanning monochromator. The radiation source is often a tungsten filament, LED, Xenon arc lamps. The detector is made from photo diode or a CCD. When the light is incident on the scanning monochromator, so polychromatic light is converted into monochromatic light.

In a double beam instrument, the light is split into two beams before it reaches the sample. First beam is passing through the solution of the compound which is kept in transparent container. And second reference beam is passing through the container, which is empty. The containers for the sample and reference solution must be transparent for the radiation so that radiation will pass through them. Most of instruments have two detectors, which measure the sample beam and the reference beam at the same time. In one detector instrument, the two beams pass through a beam chopper, which blocks one beam at a time. The detectors alternate between measuring the sample beam, the reference beam, the information display on an LCD screen. Spectrometer automatically scans all the component wavelength in the manner described [3].

CONCLUSION:

We can find out molar structural and concentration with the help of spectrophotometer. We can also find out the changes in the vibration and confirmation energy levels after and before an interaction with a substrate or another material.

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