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IR Spectrophotometer

Poster · December 2015

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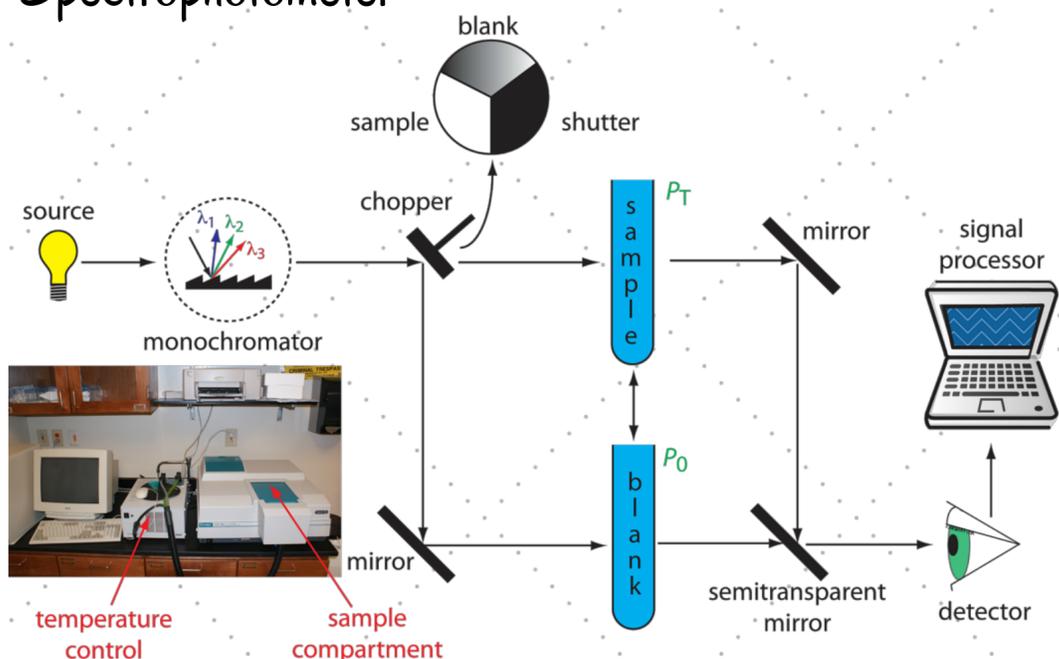
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IR Spectrophotometer

Infrared spectroscopy or Vibrational Spectroscopy; is the spectroscopy that deals with the infrared region of the electromagnetic spectrum, that is light with a longer wavelength and lower frequency than visible light.

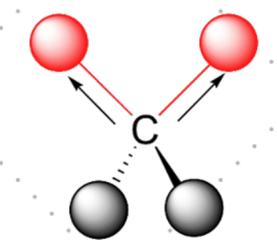
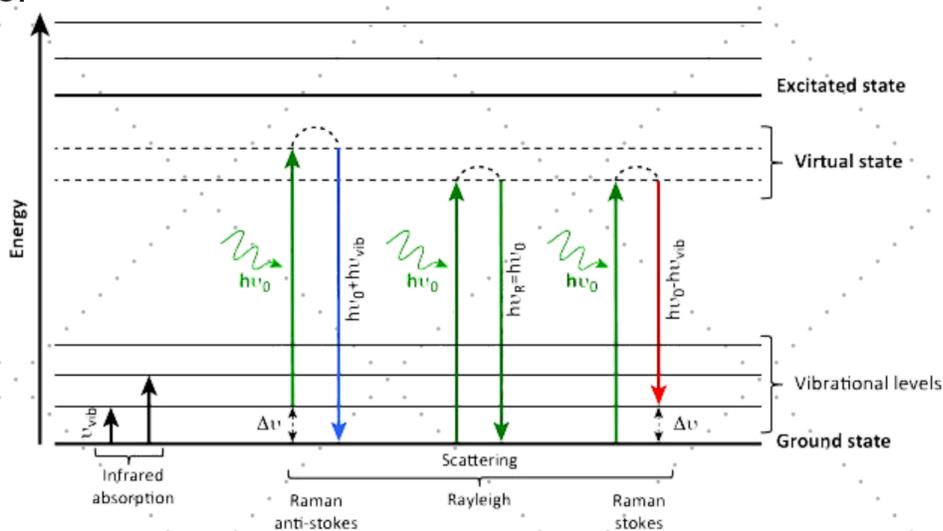


The components of an IR machine are IR source, beam splitter, a transducer monochromator, an analog to digital converter and a digital machine to quantify the readout. The IR light exits the source and becomes split into two beams, one to be directed to the sample the other to a reference. The intensity of the beam is measured by the intensity emitted divided by the intensity observed, also known as the Transmittance. All frequencies are measured in wave-number, $1/\text{cm}$. Add a little to make a sample with a liquid, the liquid is placed between two pure salt sheets of NaCl and for a solid it is pressure pressed with KBr to incorporate both into one sheet.

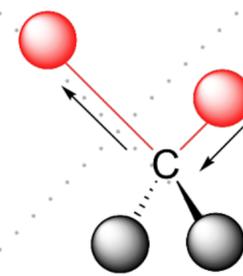
The reason for using salt to suspend the molecule is because the salt structures form a lattice that is strongly ionically bonded and will not absorb IR light because it lacks the vibrational capability. The Background scan or reference tends to be air.

THEORY

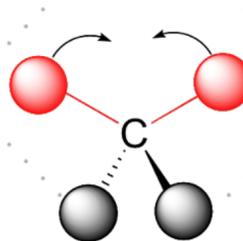
IR radiation does not have enough energy to induce electronic transitions as seen with UV, but still can give enough energy to make vibration transitions between the vibrational levels in the same electronic level. For a molecule to absorb IR, the vibrations or rotations within a molecule must cause a net change in the dipole moment of the molecule. The alternating electrical field of the radiation interacts with fluctuations in the dipole moment of the molecule.



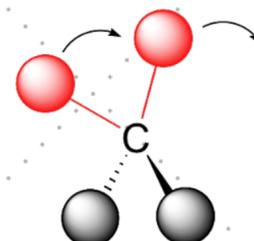
symmetric stretching



asymmetric stretching



scissoring



rocking

If the frequency of the radiation matches the vibrational frequency of the molecule then radiation will be absorbed, causing a change in the amplitude of molecular vibration. Rotational levels are quantized, and absorption of IR by gases yields line spectra. However, in liquids or solids, these lines broaden into a continuum due to molecular collisions and other interactions. The positions of atoms in molecules are not fixed; they are subject to a number of different vibrations. Vibrations fall into the two main categories of stretching and bending.

