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Introduction to the Book

Theophile Theophanides

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Infrared (IR) Spectroscopy is the most used tool today for the characterization and identification of materials, and biomaterials. In the last 20 years, its applications have been extended to large biological materials, such as proteins, DNA and membranes [1] and to healthy or diseased human tissue (e.g. cancer, atheromatic plaques, etc) [2, 3]. The technique is extensively used not only for organic compounds but almost all substances and is popular because it is simple, easy to perform, accurate and cost effective. It is hoped that in the very near future, affordable small IR instruments will be build to assist in fast pre-diagnosis and diagnosis, in clinical settings.

Functional groups like $-\text{CH}_2$, $-\text{CH}_3$, $-\text{NH}$, $-\text{OH}$, etc are easily identified from an IR spectrum and the material and biomaterial that contains them can be detected and conveniently compared with library spectra. Modern Fourier Transform Infrared (FT-IR) Spectrometers, can obtain an average of 100 to 150 spectra in the mid-infrared region, in a few seconds and with excellent resolution, a vast improvement from the past. FT-IR Spectrometers are now available at low cost (~€40,000) for the analytical chemist and the structural chemical spectroscopist. [4].

The aim of this book is to assist the chemist, spectroscopist and any other scientist interested in applying FT-IR. Presented herein are signature bands at high frequency regions ($4,000$ - $1,500$ cm^{-1}), capable of giving structural information [5-10]. The positions and intensities of the absorption bands can be used to characterize a compound from library spectra and to confirm the presence of a particular group in order to obtain information as to the structure and conformation of the molecule and its microenvironment. Skeletal vibrations of molecules ($1,500$ - 400 cm^{-1}) can change substantially with conformational changes. However these should be used with caution and cannot be applied with a high degree of confidence to structural modifications taking place to large biomolecules. It is in assisting the IR spectroscopist in determining with confidence any particular identification and characterization of a molecule from "signature bands", that this monograph aims to be of value.

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