

## Infrared Spectrophotometer, FTIR

### Scope:

FTIR generates an absorption 'fingerprint' of compounds in the infrared (heat) spectral region, each absorption peak corresponding to the vibrational frequency of a specific chemical group. Like our fingerprints, the spectrum of each compound is unique. This property is used to identify materials and quantify their concentration (eg. the concentration of UV absorbers in plastics films).

### Test procedure:

For industry applications, FTIR is typically used for quality control of materials or contaminant analysis. A range of sampling techniques is available, this includes analysis of surfaces using reflectance spectroscopy (ATR) and identification of impurities using the attached IR microscope. The microscope can image down to an area of  $\sim 25\mu\text{m}^2$ . A typical infrared scan (spectrum) is generated in the mid-infrared region from  $400\text{ cm}^{-1}$  to  $4000\text{ cm}^{-1}$  (wavenumbers). Unknown spectra can be compared to reference spectra in a computer-based library or analyzed using attached software.

### Sample types and quantities:

Typical samples are polymer pellets, parts of mouldings, opaque samples (surface/ATR analysis), fibres, powders, wire coatings and liquids. Multilayer films can be identified using the microscope.

Data Absorption peaks of unknown samples are matched to the peaks of known materials. The better the match, the higher the certainty of a correct identification. FTIR spectral analysis can easily identify classes of polymers such as styrenics, nylons, polyolefins and polycarbonates. FTIR alone should not be expected to identify the specific type of nylon or copolymer, however this is possible using a combination of FTIR and thermal analysis (DSC) techniques.

### Internal polymer additives:

The amount of additive in a polymer that can be detected depends on the degree to which the additive absorbs infrared energy. Quantitative analysis of additives at  $<1\%$  concentration is obtainable, however this is only possible if the additives absorbs at a different frequency to the polymer. Contaminants can also be identified, however quantitative results are not normally required.

### Surface contamination:

Surface contaminants can be identified either by surface (ATR) or IR microscope techniques.

