Introduction to Fourier Transform Infrared Spectroscopy (FTIR)

FTIR measures infrared absorption and emission to identify chemical bonds.

This non-destructive technique is vital in materials science, chemistry, and pharmaceuticals.

Fundamentals and Principles of FTIR

Infrared absorption

Molecules absorb IR radiation at frequencies matching vibration modes.

Fourier Transform

Converts raw interferogram data into a readable spectrum.

Vibrational frequencies

Specific to molecular bonds, unique fingerprints for identification.

Uses and Applications of FTIR

Material Analysis

- **Polymer characterization**

- **Chemical compound ID**

- **Coating analysis**

Pharmaceuticals & Food

- **Drug purity checks**

- **Adulteration detection in foods**

- **Environmental pollutant analysis**

Sample Requirements and Applicable Materials

Sample Forms

Solids, liquids, and gases can be analyzed.

Preparation Methods

KBr pellets, thin films, ATR technique.

Material Types

Polymers, organics, inorganics, coatings.

Limitations

Strong water absorption and particle size effects.

FTIR Data Acquisition and Results

Data Form

Interferogram converted to Absorbance vs. Wavenumber spectrum.

Peak Analysis

Peaks correspond to molecular vibrations showing chemical groups.

Preprocessing

Baseline correction and normalization improve accuracy.

Data Interpretation and Property Calculation

Identify Functional Groups

Peak positions reveal groups like C=O or N-H.

Quantify Concentrations

Peak intensity proportional to compound amount.

Advanced Analysis

Deconvolution resolves overlapping peaks for clarity.

Calculations

Crystallinity index from peak ratios in polymers.

Research Example: Polymer Blend
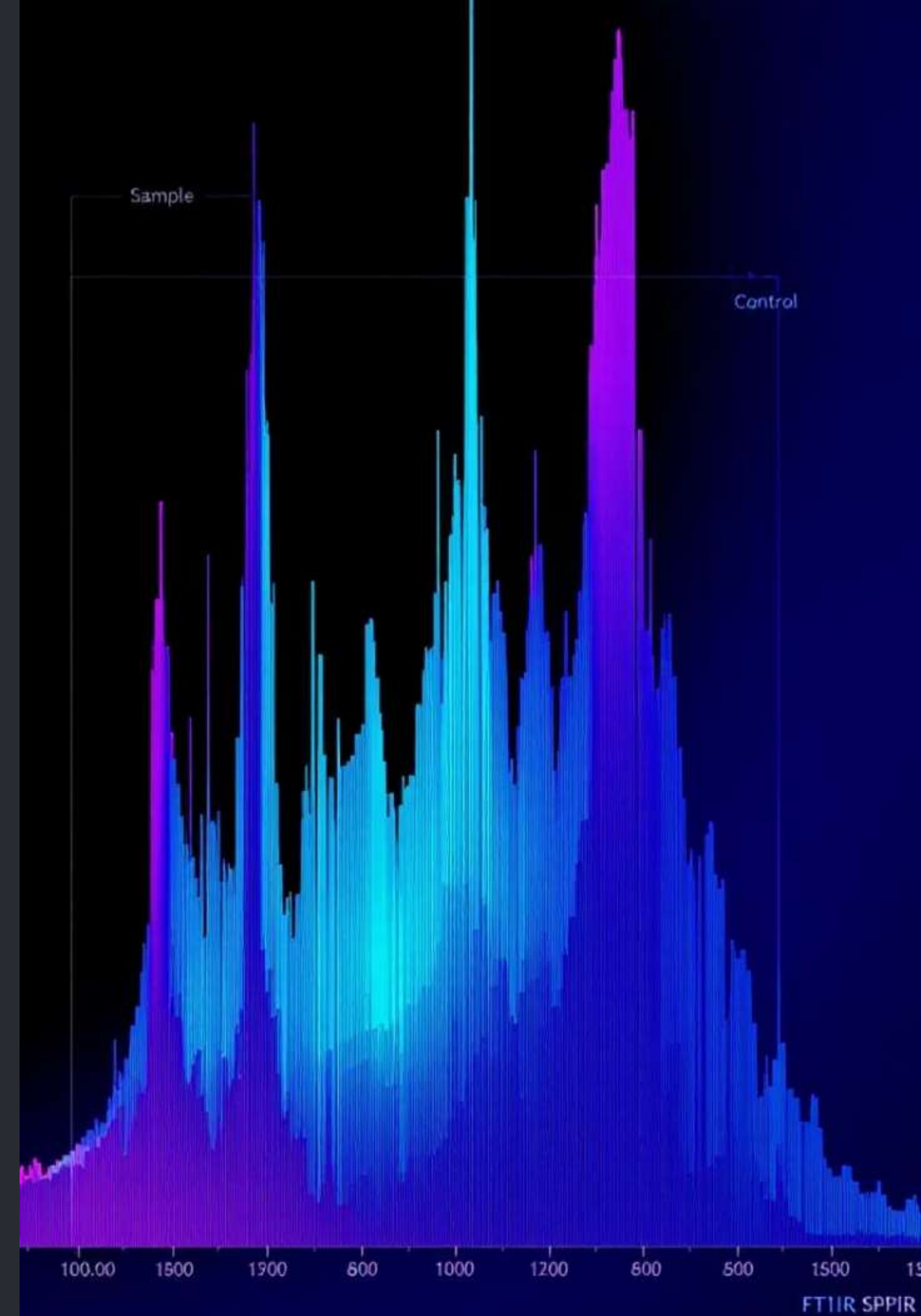
1 Study Insight

Peak shifts indicate polymer miscibility.

2 Calculations

Blending degree estimated using peak area ratios.

3 Conclusion

FTIR confirms molecular interactions in blends.

Summary and Conclusion

Powerful Tool

Essential for diverse material characterization.

Expansive Applications

Used in polymers, pharmaceuticals, environment, and food.

Data Interpretation

Requires understanding of vibrational spectra and calculations.

Advancements

Ongoing improvements enhance accuracy and sensitivity.

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