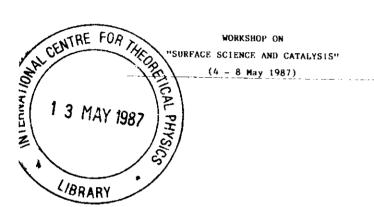


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FOURIER TRANSFORM INFRARED SPECTROSCOPY
(Summary)

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These are preliminary lecture notes, intended only for distribution to participants.

FOURIER TRANSFORM INFRARED SPECTROSCOPY

The first section of the lecture will be concerned with an introduction to the basic principles of molecular vibrations, characteristic group frequencies and the use of infrared spectroscopy for identifying molecular species. I go on to discuss experimental aspects and to compare dispersive instruments with Fourier Transform instruments. Finally the application of transmission infrared spectroscopy to high surface area 'catalyst-like' materials will be contrasted with the application of reflection-absorption infrared spectroscopy (RAIRS) to single crystal metal samples.

The second section of the lecture will concentrate on some specific examples. Spectra of ethane, ethene and ethyne on a Cu(111) surface will be analysed to illustrate the application of the metal surface selection rule.

Adsorption of ethylene on platinum surfaces will be used to illustrate the interplay between studies of single crystal surfaces and work on catalysts.

Adsorption and decomposition of methanol on Cu(111) will be used to illustrate possibilities for monitoring surface reactions.

Finally the prospects for improvements in the RAIRS technique will be discussed.

Outline:

- Molecular Vibrational Spectroscopy[1,2] simple harmonic oscillator normal modes of vibration characteristic group frequencies
- Infrared Spectroscopy[1,2]
 excitation mechanism
 selection rules
 instruments dispersive
 routine sensitivity.

1

Principles of FTIR[3]
 Michelson interferometer

interferogram
typical mid-i.r. instrument

- advantages vs dispersive instruments
 - a) multiplex
 - b) throughput
 - c) wavenumber accuracy
- 4. Application of Transmission Infrared Spectroscopy to High Surface Area, 'Catalyst-Like' Samples[4,5] nature of supported metal samples sample size i.r. absorption by oxide support importance of FTIR.
- Reflection-Absorption Infrared Spectroscopy (RAIRS) [6,7,8]
 history
 metal surface selection rule > sample size and sensitivity
 FT-RAIRS
 comparison with EELS
- Examples
 ethane, ethene and ethyne on Cu(111)
 methanol and methoxy on Cu(111)
 kinetic studies
- Prospects for the Future improved sensitivity improved spectral range

References

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 (especially early part on symmetry and selection rules.)
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