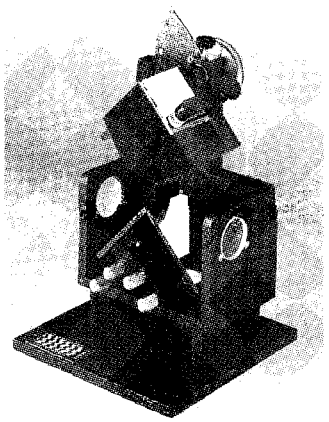
FINDING THE PATH

TO OPTIMUM RESULTS

THE Vertex™

High-Throughput Variable Angle Specular Reflectance



Applications

- Variable thickness solid samples
- Coatings on metals and plastics
- Epitaxial layers in Si wafers
- Surface-treated metals
- Lubricated surfaces
- Robust and fragile samples

The Standard

- 5 - 85° angle of incidence with 1° resolution
- Factory-calibrated reference dial
- Easy user-calibration and position lock
- Simultaneous rotation of sample and mirror planes for constant pathlength
- Kinematically mounted for stability
- KBr input/output conditioning lenses
- 50% throughput provides excellent signal to noise resolution
- Easy interface with most spectrometers

The Options

- Gold-coated mirrors
- Purge enclosure
- Mirrors with UV coatings
- Wire grid polarizer

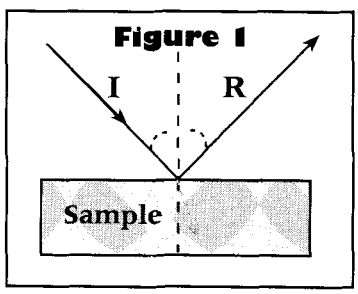
CIC Photonics

The Technical Problem

The non-destructive characterization of metal and plastic coatings, epitaxial layers, surface treatments, films, powders, and other materials is becoming increasingly important as researchers and process chemists seek to develop new products for business and industry. In addition, multiple analysis techniques are required to ensure the discriminate identification of materials that vary only slightly from one physico-chemical formulation to another. Since many new solids are now used in micron or sub-micron thicknesses, techniques are sought which can characterize property differences at the sub-micron scale. Variable angle specular reflection measurements offer a leading solution.

The Theoretical Solution

Specular reflection is a mirror-like reflection from the surface of a sample. Infrared radiation is directed onto the surface of a sample. The angle of reflection (R) is equal to the angle of incidence (I); see Figure 1. The amount of radiation reflected is a function of the sample's index of refraction, absorption properties, surface roughness, and the angle of incidence of the infrared radiation.



The specular radiation process collects only the radiation reflected off the sample's surface that is closest to the beam. When specular reflectance is measured at or near normal incidence (the usual case), the reflected energy is small—only 5 - 10%—for most organic materials in those regions where the material is non-absorbing. However, in regions of strong absorption, the reflected energy is much greater. The reflected radiation intensity data are often quite different from the transmission spectra, since derivative shaped bands are the result of the superposition of the normal extinction coefficient spectrum and the refractive index dispersion.

Strongly absorbing materials, such as silicates, intensely reflect radiation over a specific energy range, producing unique spectral features called *reststrahlen* bands. Many minerals and glasses are characterized by these spectra.

The increased usefulness of the specular reflection technique is a function of the development of computer software for fast Kramers-Kronig transform calculations. Now, specular reflection data that are difficult to interpret can be quickly transformed into readily interpreted transmission-like spectra almost instantaneously.

The Product Solution

The Vertex™ —Variable Angle Specular Reflectance Accessory— by CIC Photonics has been designed to permit measurements of the reflectance of a solid sample material while varying the angle of incidence (AOI) of

the source illumination. This is accomplished by simultaneously rotating the sample and a fixed mirror about a point coincident with both planes. The AOI on the sample varies inversely with that on the mirror; the net result is minimal translation of the beam and constant pathlength.

The range of rotation is approximately 80°, which produces angles of incidence from approximately 5° to 85°. At the extremes of this range, clipping by both the leading and trailing surfaces results in only a few percent of the beam actually passing through the system, limiting the usability of the system.

The device provides for holding a sample with a single, spring-loaded clamp. The clamp may be rotated to apply pressure near the center of the sample or, if the sample is delicate, the clamp may be rotated to one side where the force of the clamp is opposed by a supporting clamp (see Diagram). Once affixed, the sample may then be positioned by rotating the knurled stainless adjustment wheel on the rear of the unit. The small thumb screw on top of the unit locks the position once it is established.

A reference dial is attached to the adjustment wheel and indicates, by alignment with the top edge of the accessory, the angle of incidence on the sample within one-degree precision. The dial is factory-calibrated before shipment but may easily be adjusted in order to recalibrate if desired.

The Purchase Solution

The Vertex™ comes equipped with KBr conditioning lenses for FT-IR spectrometers with an f/5 source beam; no lenses are required for the collimated beams of UV/VIS spectrometers. The standard FT-IR mirrors are non-overcoated aluminum mirrors. The UV/VIS version uses dielectric-overcoated aluminum mirrors. Also included are adjustment tools, a reference mirror, and a shipping case.

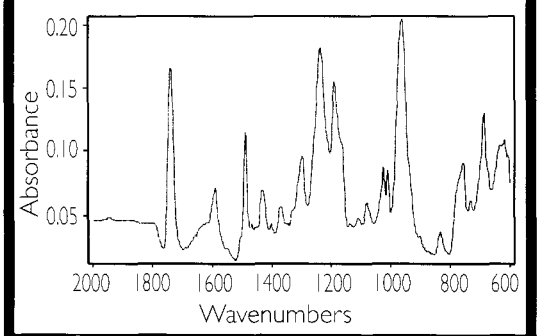
Product Numbers

Vertex-FTIR	14B100
Vertex-UV/VIS	14B200
Gold Coated Mirrors	14B110
Purge Enclosure	14B150
Wire Grid Polarizer	14B160

Other Related CIC Photonics Sampling Accessories

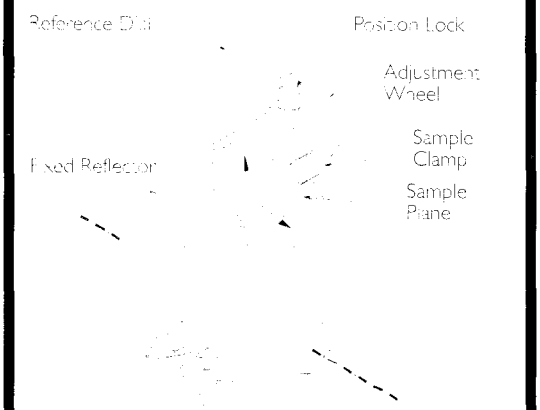
The Explorer	Horizontal ATR Accessory	42B100
The Insider	FT-IR Emission Accessory	09B100
The Fresnel-ATR	Horizontal ATR, AMTIR/Solids	57B200
The Micro-Press	Microscope Compression Stage	30B100
The Spec-45	Fixed (45°) Angle Specular Reflectance	35B100
The Roadrunner	Diffuse Reflectance	15B100
The NIC-ATR	Research Vertical ATR for Nicolet	28B000
The Scout	15-cm Direct Pass Transmission Gas Cell	38B100

Specular Reflectance Record of a Film Sample



Pre-cote 25 spray protective coating

Vertex Diagram



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