Magna-IR® 860

A powerful research FT-IR spectrometer with unlimited sampling flexibility

The Magna-IR 860 spectrometer combines superior performance and advanced data collection technology with unlimited research capabilities. The Magna-IR 860 simultaneous synchronous techniques (SST™ module) with dual digital signal processors (DSP) provides the basis for enhanced data collection and signal control features. Advanced data collection capabilities available for the Magna-IR 860 include step-scan data collection, dual channel spectroscopy, advanced rapid and slow scanning data collection, and time resolved spectroscopy (TRS). These advanced features are controlled through Research OMNIC® software providing a fully Windows® compatible interface for data collection and processing.

The Magna-IR 860 provides a wide range of linear scan data collection frequencies, and amplitude modulation (AM) and phase modulation (PM) step-scan data collection. Utilizing the DSP technology of the Magna-IR 860,

in-phase and quadrature spectra are collected simultaneously to efficiently and conveniently provide complete depth profiling information from a single data collection. The SST module also eliminates the need for external lock-in amplifiers for step-scan data collection.

Optional dual-channel spectroscopy features enable simultaneous, synchronous collection of two channels of data for experiments such as photoelastic modulation infrared reflection absorption spectroscopy (PM-IRRAS), vibrational circular dichroism (VCD), vibrational linear dichroism (VLD), and other dual channel experiments. Optional TRS capabilities provide for the collection of ultra fast elastic chemical or electronic transformations.

The Magna-IR 860 utilizes the rapid scanning, digital signal processor (DSP) driven Vectra-Plus™ interferometer capable of better than 0.09 cm^{-1} resolution and rapid scanning rates in excess of 45 scans per second. The Vectra-Plus interferometer provides continuous dynamic alignment for exceptional long-term stability for linear and step-scan data collection. AutoTune™ alignment, the quick release Talon™ beamsplitter locking mechanism, and latched access door of the Magna-IR 860 provide the capability for changing spectral ranges within seconds without loss of system purge. A wide variety of beamsplitter and detectors are available for spectral range coverage from 25,000 to 50 cm^{-1}. The high-intensity, Ever-Glo™ mid-infrared source requires no external utilities, is stable and extremely reliable. Standard, computerized dual sources offer convenient flexibility for access to the near-IR or visible spectral regions.

The base of the Magna-IR 860, the Stabilizer™, is a precision-cast baseplate with precision-pinned positions for all optical components. Its Stonehenge™ mirrors are monolithic, diamond-turned and pinned-in-place on the baseplate for permanent stability and alignment. The Magna-IR 860 provides for user-changeable, pre-aligned components such as the laser, source and detectors, which significantly minimize the cost of system maintenance. Up to 4 external beams are available with the Magna-IR 860. The front facing SeaPort™ optics provide an optional external beam, which may be used for integrated near-IR fiber optic sampling, emission spectroscopy, or as an additional external sampling port. An optional, integrated near-IR fiber optics sampling accessory provides immediate access to the near-IR spectral range.

Standard features of the Magna-IR 860 include step-scan data collection, computerized dual detector positions, an automated, continuously variable aperture that optimizes energy

from the infrared source, and sample compartment purge shutters that maintain the sampling environment. The large sample compartment with Snap-In™ kinematic mounted baseplate eliminates the need for manual alignment when changing sampling accessories.

Powerful Research OMNIC software for the Magna-IR 860 provides a fully Windows compatible interface for data collection and processing. Each of the standard or advanced data collection features of the Magna-IR 860 includes a menu pull down with interactive parameter input to optimize collection parameters with visual and digital response.

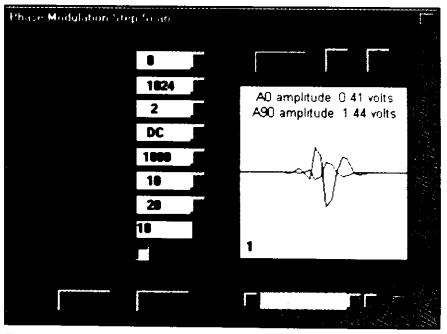

Figure 1: Research OMNIC provides interactive parameter selection for step-scan data collection

Extensive On-Line Help guides the researcher in experiment and parameter set-up for advanced research applications.

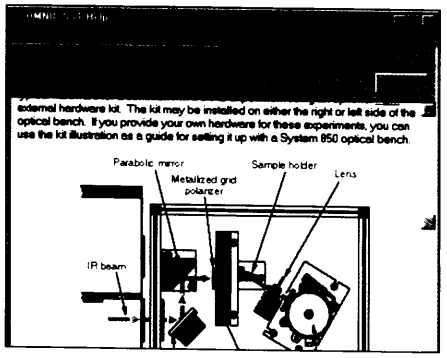

Figure 2: Research OMNIC's on-line help assists in the set-up and use of advanced experiments

In addition to its advanced data collection features, a full range of sampling modules and accessories are available for the Magna-IR 860, including FT-Raman, research infrared microscopes, GC/IR and TGA/IR modules. Auxiliary experiment modules (AEM) may be coupled to the right or left side of the instrument to provide additional sampling compartments. Mid and near-IR fiber optics accessories are available to provide remote sampling capabilities. A wide variety of pre-aligned, pinned-in-place sampling accessories are available for the Magna-IR 860. Many of these accessories may be automated through the signal and control capabilities of the Magna-IR 860 sample compartment.

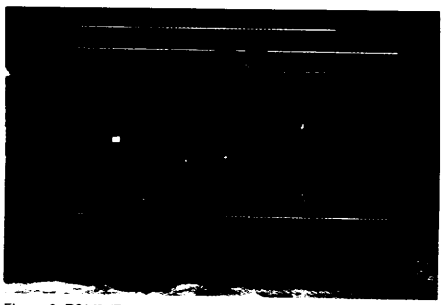

Figure 3: TOM™ (Tabletop Optics Module) accessory for Magna-IR spectrometers is exceptionally flexible for custom configurations

EXPERIMENTAL

Standard research features of the Magna-IR 860 includes linear scan velocities from ultra slow to ultra fast. The precision slow scanning velocities can be used in conjunction with photoacoustic spectroscopy to obtain a broad range of depth profiling studies.

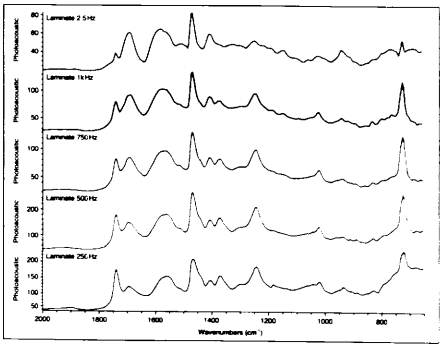

Figure 4: PAS depth profiling experiment of a polymer laminant using precision slow linear scanning velocities of the Magna-IR 860

The Magna-IR 860's wide selection of ultra fast scanning velocities provide complete optimization for rapid scan kinetic experiments. Advanced data manipulation features of Research OMNIC include contour and waterfall displays for step-scan, Series, and time or modulation resolved data.

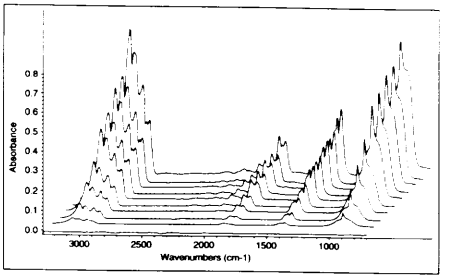

Figure 5: Rapid scan kinetics measurement of ethylene gas mixture

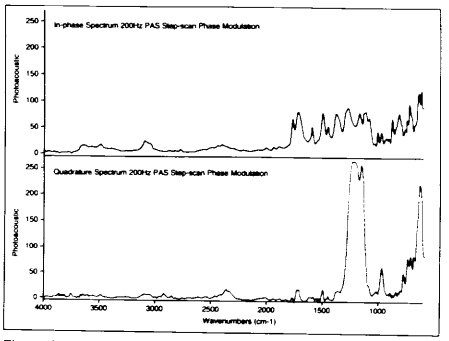

Figure 6: In-phase and quadrature spectra of a multi-layered polymer collected simultaneously in PM step scan mode

The Magna-IR 860 includes linear and step-scan data collection capabilities. Step scan data collection provides a constant modulation frequency over the entire spectral domain and therefore is ideal for depth profiling studies.

Dual channel spectroscopy options for the Magna-IR 860 offer input for two simultaneous, synchronous channels of data for experiments such as PM-IRRAS, VCD, VLD and many more.

The PM-IRRAS experiment performs surface science measurements without the problem of atmospheric water absorptions because the sample and the background are collected simultaneously.

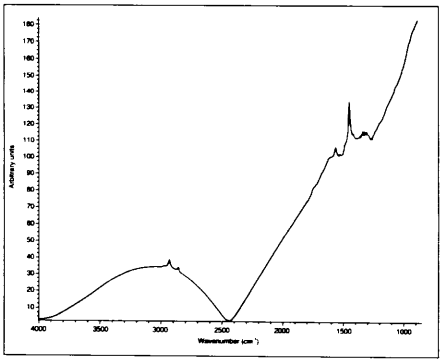

Figure 7: PM-IRRAS spectrum of a single monolayer of cadmium arachidate

Exploring the structural and stereochemical dimensions of polymers and other oriented molecules is provided with the optional VLD and VCD features of the Magna-IR 860. These synchronous dual channel experiments provide key information only available from a high performance research spectrometer.

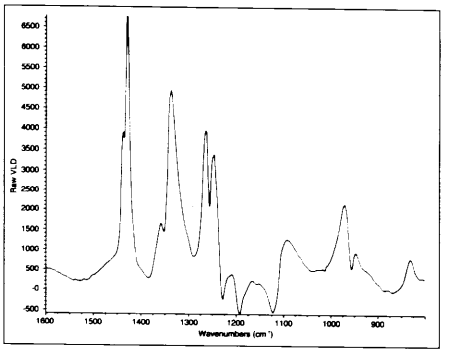

Figure 8: The VLD spectrum of PVC showing the orientation characteristics of side chains in the stretched polymer state

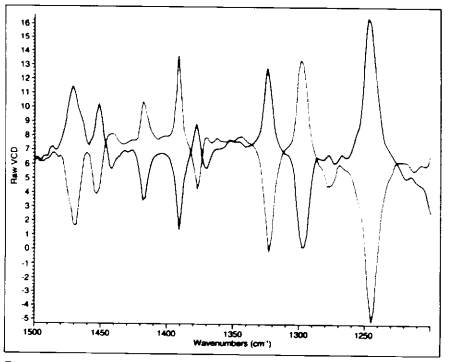

Figure 9: The VCD spectrum of the R and S optical isomers of camphor. Biological activity specifics can be studied at the molecular level with the Magna-IR 860

Magna-IR 860 Specifications

SYSTEM COMPONENTS

System Baseplate:
Precision-cast Stabilizer baseplate with pre-aligned, pinned locations for sampling accessories, laser, source, detector and mirrors

System Cover:
Unit construction with 4 external beam ports, standard purge shutters, and removable sample tray. Latched beamsplitter hatch for spectral range change without purge loss. Dual detector hatch with kinematic mounts for up to 2 liquid nitrogen cooled detectors. Latched sample compartment cover with interchangeable Flex-Top™ slide sample covers.

System Purge/Seal:
Purge ports included for sample compartment, accessories, and system; patent pending Purge Curtain™ for laminar flow of purge gas in sample compartment; purged and/or sealed and desiccated configuration; desiccated option includes visual moisture indicator and exchangeable/reusable desiccant packs

Mirror Optics:
Stonehenge proprietary optical design utilizing monolithic, diamond-turned, pinned-in-place mirrors

Optical Layout:
Efficient, precision design using a single mirror from beamsplitter to sample focus and a single ellipsoidal mirror from sample to detector

Sources:
Thermally stable, high-energy Ever-Glo mid/far-IR source operates at 1525K; spectral range of 9,600-50 cm^{-1}; quartz-halogen near-IR source operates at 2970K; spectral range of 25,000-2000 cm^{-1}

Source Optics:
Standard dual computerized source positions; pre-aligned, pinned source position for easy replacement of sources

Source Aperture:
Continuously variable, computerized iris aperture; automatically sized with the selection of spectral resolution

Reference Laser:

Helium Neon laser operating at 15,798 cm^{-1}; pre-aligned, pinned-in-place and user replaceable with no alignment; laser beam concentric with IR beam in sample compartment

Interferometer:
Linear and step scanning Vectra-Plus interferometer with frictionless electromagnetic drive and digital dynamic alignment provides excellent long-term stability and optimal spectral peak shapes; interchangeable beamsplitter mount with Talon lock mechanism; beamsplitter change enhanced by computerized AutoTune of fixed mirror

Beamsplitters:
Storage case for 2 additional beamsplitters within the sealed/purged environment of the interferometer

Standard	KBr	7,400-350 cm^{-1}
Optional	XT-KBr™	11,000-375 cm^{-1}
	CsI	6,400-200 cm^{-1}
	Quartz	25,000-2,800 cm^{-1}
	CaF_2	14,500-1,200 cm^{-1}
	Solid-Substrate™	700-50 cm^{-1}

Sample Compartment:
Large (21 cm wide x 26 cm deep x 18 cm high) sample compartment with pre-aligned, Snap-In baseplate; dual slot, adjustable height slide sample holder; sample compartment detector input, control bus and 2 auxiliary connectors for automated accessory control

Detector Optics:
Pre-aligned, pin mounted front and rear positions for easy exchange of detectors without alignment. Standard Monoflect™ computerized dual front and rear internal detector positions

Detectors:
Pre-aligned and pinned-in-place. All detectors include preamplifiers with adjustable gain control; liquid nitrogen cooled detectors utilize patented Nicolet dewar with "No-Ice" element and 18 hour hold time

Standard	DTGS/KBr	12,500-350 cm^{-1}
Optional	DTGS/CsI	6,400-200 cm^{-1}
	Silicon	25,000-8,600 cm^{-1}
	PbSe	13,000-2,000 cm^{-1}
	InSb	11,500-1,850 cm^{-1}
	MCT-A	11,700-600 cm^{-1}
	MCT-B	11,700-400 cm^{-1}
	DTGS/PE	700-50 cm^{-1}

External Beam Optics:
Optional Passport™ dual, right and left external beam optics; computer controlled single optical element sending collimated beam to external sampling modules; optional external SeaPort optics provides front facing external beam or emission optics; optional right side emission optics

Fiber Optics:
Optional integrated SabIR™ fiber optics accessory providing computerized access to near-IR sampling

SYSTEM ELECTRONICS

On Bench Controller (OBC):
Controls all bench operations including interferometer scan, beam path, and data communication to the PC; the powerful DSP based OBC provides nanosecond control of system operation; system diagnostics, through the OBC, report the condition of the laser, source, power supply, electronics, and infrared signal strength in real time

Simultaneous Synchronous Techniques (SST) Module:
DSP based electronics control module provides for simultaneous collection of secondary signals; SST module multi-channel input compartment provides independent BNC signal input channels with 4 Kohm impedance and +10 volt signal range, synch input for multiple modulation experiments, and auxiliary signal channel input

Analog-to-Digital Converters (ADC):
Two independent electronically balanced, 100 kHz, 20 bit high-speed ADCs provide accurate digitization at precise laser crossings

Detector Preamplifiers:
Low-noise, high linearity detector preamplifiers

System Interface:
ISA interface using Nicolet virtual device driver for high-speed data acquisition and data transfer rates; check-sum verification of every collected interferogram ensures integrity of data transfer from spectrometer to data station

SYSTEM FEATURES

Linear Scan Velocities:
User selectable from 0.0158 cm/sec (250 Hz) to 8.22 cm/sec (120 KHz)

Rapid Scan Collection:
Greater than 45 scans per second at 16 cm^{-1} resolution (8 cm^{-1} data point spacing) with interferograms written directly to the hard disk of the PC; user defined unidirectional or bi-directional data collection and single or double sided interferograms

Step-Scan Data Collection:
Amplitude or phase modulation step scan capabilities; internal PM frequencies from 25 to 1000 Hz; real-time interferogram display during parameter selection; simultaneous collection and real-time display of in-phase and quadrature spectra, significantly reducing total collection time for depth profiling

experiments; phase angle continuously selectable from 0 to 360 degrees

Dual Channel Spectroscopy:
Optional dual channel photoelastic modulation (PEM) experiments; optional electronic accessories and OMNIC software for experiments such as PM-IRRAS, VCD, VLD, and other dual channel experiments (see Nicolet experiment sheet, 169-717400)

Time Resolved Spectroscopy (TRS):
Optional TRS data collection software for measurement of elastic chemical or electronic changes in the ultra high speed time domain

Spectral Resolution:
Standard, nominal 0.125 cm^{-1} (better than 0.09 - unapodized) measured with 4 Torr carbon monoxide

Signal-to-Noise Ratio:
Better than 30,000/1 peak-to-peak (135,000/1 RMS) average SNR in 1 minute measurement time at 4 cm^{-1} resolution with triangular apodization using a KBr beamsplitter and DTGS detector

ASTM Linearity:
Less than 0.07 %T deviation from 0.0 %T (100-0 %T scaling) measured at 4 cm^{-1} resolution using 3 mil polystyrene

SYSTEM SOFTWARE

Software Design:
OMNIC software with pull-down menu options for all display, collection, and processing features; compatible with Microsoft® Windows standards

OMNIC SST Options:
Fully Windows compatible pull-down options for all research OMNIC features such as step-scan data collection, dual channel spectroscopy and time resolved spectroscopy

Customizable Menu:
All pull-down menu options of OMNIC are fully customizable with Password protection for tailored system operation

Parameter Selection:
Interactive, real-time display of data during parameter and beam path selection

Data Collection:
Real-time and interactive display of fully processed spectra during data collection

Spectral Header:
Identifies collection and processing parameters for each spectrum including detector identification, spectral resolution, apodization, scan velocity, baseline correction points, or subtraction factors; the non-editable spectral header provides a traceable record of data integrity

Library Search:
Standard OMNIC library search package with 16 bit ordinate resolution and user selectable search algorithm; library build included with user definable spectral resolution to 0.0625 cm^{-1} data point spacing

Standard and Optional Software:
System validation, system diagnostics, macro development, spectral interpretation, kinetics software, a complete line of general and specific FT-IR high resolution spectral data bases and many more

SYSTEM ACCESSORIES

External Sampling Accessories:
Research grade infrared microscopes for right or left side of system, auxiliary experiment module (AEM) for right or left side of instrument, Table Optics Module (TOM) enabling development of flexible optical experiments mounts on right or left side, FT-Raman accessory for right side of instrument, GC accessory for right side of instrument, TGA accessory for right, left or main sample compartment locations; for other options please call Nicolet

Sample Compartment Accessories:
Accommodates attenuated total reflectance (ATR), diffuse reflectance (DRIFTS), specular reflectance, photoacoustic accessory (PAS), automated sample wheel, mid and near-IR fiber optics accessories, short and long path gas cells, emission accessory, solid and liquid sample holders and all commercial sampling accessories; all sample compartment accessories are pre-aligned on Snap-In kinematic baseplates

PHYSICAL CHARACTERISTICS

Computer Requirements:
Minimum Pentium® 60 MHz with 8 Mbytes RAM, 300 Mbytes hard disk, math coprocessor, and AT bus

Power Requirements:
(bench with computer) 120V, 3 A, 60 Hz, or 240 V, 1.5 A, 50 Hz

Optical Bench Dimensions:
67 cm (W), 63 cm (D), 45 cm (H)

Weight: 68 kg

Regulatory Approvals: CE, TUV and UL

WARRANTIES

Warranty:
One year full warranty on the complete Magna-IR 860; five year warranty on the Ever-Glo source and interferometer components

Nicolet
INSTRUMENTS OF DISCOVERY

ISO 9001

A subsidiary of Thermo Instrument Systems, Inc., a Thermo Electron company

Nicolet has direct subsidiary offices in North America, Europe and Japan.
To complement these direct subsidiaries, Nicolet maintains a network of representative organizations in countries throughout the world.

Nicolet Instrument Corp. • 5225 Verona Road • Madison, WI 53711-4495 • U.S.A. • TEL: 800-232-1472, 608-276-6100 • FAX: 608-273-5046 • E-MAIL: nicinfo@nicolet.com • WEB: http://www.nicolet.com/

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