GRIM®3 - a new system for the forensic examination of glass fragments

NEW FEATURES INCLUDE:

- Multiple RI measurements for greater efficiency
- Improved temperature stability
- Enhanced casework documentation
- Network facilities for remote supervision
- Choice of operating languages
- Data export facilities
GRIM® 3 is Foster & Freeman’s latest system for measuring the refractive indices of glass fragments. Redesigned to take advantage of improved operating systems, faster microprocessors and new high resolution CCD imaging devices, GRIM® 3 offers new features to assist the forensic examination of glass.

**Principle of operation**

GRIM® 3 retains the widely accepted laboratory technique of glass RI determination, the oil immersion/temperature variation method. The system operates through a standard laboratory microscope with phase contrast optics and a Mettler hotstage, for temperature control.

By varying temperature to alter the refractive index of a calibrated oil, the RI of an immersed fragment of glass can be determined at the point of null refraction, the point at which the refractive indices of glass and immersion oil match. Using GRIM® 3, repeat measurements produce results with a standard deviation of, typically, 0.00002RI over a 5 hour period and 0.00003RI over a 5 day period.

The comprehensive casework database allows all glass data to be retained, including images and edge contrast versus temperature traces.
The efficiency of GRIM® 3 is improved by the use of four glass edge processing windows. The use of new high-speed processors enables GRIM® 3 to monitor up to four glass fragment edges per operation, speeding the casework examination process as well as reducing immersion oil calibration time. The four image-processing windows, adjustable for size and shape, may be positioned independently over the edge of the examined glass fragment, allowing the operator to select the best edges and avoid impurities. With four null point temperature measurements per run, the number of runs required to provide an acceptable level of statistical accuracy is reduced, saving time.

Casework files and reports
Casework management and database facilities have been improved. GRIM® 3 ensures that casework results cannot be filed without essential information that identifies each fragment of glass examined, including its source and casework reference, and the identity of the operator. Glass fragment images and edge contrast traces may also be saved for reference and fragments may be sized using the on-screen scale. The operator may flag results as erroneous or deleted, but all results are retained in the databases. GRIM® 3 includes an Audit Trail feature to track data recording activity. Instrument and laboratory codes are cited on all printouts.

Basic statistics are generated including average, range, spread and standard deviation. Results may be displayed as scatter diagrams and formatted for exportation to Microsoft Office for additional analysis.

Networking facilities enable GRIM® 3 instruments to be accessed remotely, allowing casework reviews to be conducted by laboratory supervisors or reporting officers without interrupting operators.

Match point detection
GRIM®3 identifies a glass/oil refraction null point automatically by monitoring the edge of the immersed glass fragment as the oil is heated or cooled. When edge contrast drops to a minimum, the refraction null point is attained and the temperature is recorded. Phase contrast microscopy is used to enhance the edge. Each recorded null point temperature is automatically labelled with a 'quality' code ranging from 0 to 99, which is a measure of the sharpness or resolution of the null point and provides evidence of accuracy in casework reports.

Multiple glass edge processing
The use of new high-speed processors enables GRIM® 3 to monitor up to four glass fragment edges per operation, speeding the casework examination process as well as reducing immersion oil calibration time. The four image-processing windows, adjustable for size and shape, may be positioned independently over the edge of the examined glass fragment, allowing the operator to select the best edges and avoid impurities. With four null point temperature measurements per run, the number of runs required to provide an acceptable level of statistical accuracy is reduced, saving time.

Graphical presentations
Casework measurements may be displayed with distribution histograms and their mean and standard deviations for visual comparison.

Casework files and reports
Casework management and database facilities have been improved. GRIM® 3 ensures that casework results cannot be filed without essential information that identifies each fragment of glass examined, including its source and casework reference, and the identity of the operator. Glass fragment images and edge contrast traces may also be saved for reference and fragments may be sized using the on-screen scale. The operator may flag results as erroneous or deleted, but all results are retained in the databases. GRIM® 3 includes an Audit Trail feature to track data recording activity. Instrument and laboratory codes are cited on all printouts.

Networking facilities enable GRIM® 3 instruments to be accessed remotely, allowing casework reviews to be conducted by laboratory supervisors or reporting officers without interrupting operators.

Match point detection
GRIM®3 identifies a glass/oil refraction null point automatically by monitoring the edge of the immersed glass fragment as the oil is heated or cooled. When edge contrast drops to a minimum, the refraction null point is attained and the temperature is recorded. Phase contrast microscopy is used to enhance the edge. Each recorded null point temperature is automatically labelled with a 'quality' code ranging from 0 to 99, which is a measure of the sharpness or resolution of the null point and provides evidence of accuracy in casework reports.

Multiple glass edge processing
The use of new high-speed processors enables GRIM® 3 to monitor up to four glass fragment edges per operation, speeding the casework examination process as well as reducing immersion oil calibration time. The four image-processing windows, adjustable for size and shape, may be positioned independently over the edge of the examined glass fragment, allowing the operator to select the best edges and avoid impurities. With four null point temperature measurements per run, the number of runs required to provide an acceptable level of statistical accuracy is reduced, saving time.

Graphical presentations
Casework measurements may be displayed with distribution histograms and their mean and standard deviations for visual comparison.

Networking facilities enable GRIM® 3 instruments to be accessed remotely, allowing casework reviews to be conducted by laboratory supervisors or reporting officers without interrupting operators.
**Improved accuracy**

GRIM®3 features a new hot stage controller which has improved the temperature stability of the system and reduced long term temperature drift.

High-speed processing *(minimum system requirement is 2GHz)* allows the operator to optimise the sharpness of focus, ensuring a more accurate resolution of the refraction null point.

When selecting a glass edge for examination the operator is usually close to the null point temperature where image contrast is low and focussing is difficult. An unfocused image can generate results with lower 'edge counts' and a wider spread of results. The higher processing speed of GRIM®3 enables a numerical value for image sharpness to be displayed in real time which the operator can use to optimise the focus.

**Calibration**

Easy to follow procedures enable immersion oils to be calibrated with up to 12 glass standards. GRIM®3 automatically constructs a linear temperature versus RI conversion formula for each oil and calculates the correlation coefficient to qualify its accuracy. Calibration data for any number of oils and wavelengths may be stored and are password protected. Re-calibration may be undertaken at any time.

**Choice of operating system**

GRIM®3 runs on Windows 2000 and XP and is available in several languages. Networking facilities provide enhanced data communications.

**After Sales Support**

Foster & Freeman offer advice, installation, training and on-site maintenance. Please contact our Sales Department for further details of our products and services.

---

**GRIM®3: Basic Package**

- GRIM®3 processor unit with serial/USB interface for video and hotstage control, incorporating improved accuracy and temperature stability.
- Video camera interface, Matrox Meteor 2/4 (standard) PCI frame grabber.
- Monochrome CCD video camera (CCIR/EIA).
- Windows 2000 or XP compatible software.
- Microsoft Office compatible database.
- New multiple edge measurement technology.
- GRIM®3 software supplied on CD-ROM.

**Required Ancillaries**

**Computer**

Contact Foster & Freeman sales office for latest requirements/specification.

**Microscope**

Phase contrast optics.
Long working distance objective.
Phototube for mounting video camera.
100W light source.
Interference filter, 589nm peak wavelength, 10nm bandwidth.
Recommended system: Leica DM 2500 or Leica DMLB phase contrast microscope.

**Hotstage**

GRIM®3 is compatible with the Mettler hotstage model FP82HT.

**Reference Glasses**

Glass standards to cover the refractive index range 1.46 - 1.56 (data to 5 decimal places) within the temperature range 20° - 120°C and wavelength range 436 - 656nm.

**Immersion Oils**

Purified silicone oils with the refractive index range 1.46 - 1.56 within the temperature range 20° - 120°C.

---

**Choice of operating system**

GRIM®3 runs on Windows 2000 and XP and is available in several languages. Networking facilities provide enhanced data communications.

**After Sales Support**

Foster & Freeman offer advice, installation, training and on-site maintenance. Please contact our Sales Department for further details of our products and services.