Model 7404 Vibrating Sample Magnetometer

Introduction

Lake Shore Vibrating Sample Magnetometers perform magnetic measurements for materials research and development, quality control, and production testing.

The Model 7404 is capable of characterizing a variety of particulate and continuous magnetic media materials, including audio, video, and digital data tapes; flexible media; magneto-optical materials; and sputtered and plated thin film materials, including multilayer GMR, CMR, exchange-bias, and spin valve materials.

Measurements

The following parameters are either measured directly or can easily be derived through the software:

- Hysteresis loops
  - Saturation magnetization (M_{SAT}), retentivity or remanent magnetization (M_{REM})
  - Coercivity (H_C), S^*, slope at H_C, value of dM/dH or differential susceptibility at H_C
  - Switching field distribution (SFD)
  - Flatness, squareness ratio (SQR)
- Minor hysteresis loops
- Initial magnetization curve
- DC remanence
- AC remanence
- Vector measurements (m_x and m_y)
- Magnetization data as a function of time
Materials

All types of magnetic materials:
• Diamagnetic, paramagnetic, ferromagnetic, ferrimagnetic, antiferromagnetic, and anisotropic materials
• Particulate and continuous magnetic recording materials and GMR, CMR, exchange biased and spin-valve materials
• Magnetic-optical materials
• Bulk materials, powders, thin films, single crystals, and liquids are readily accommodated

Features

• Noise floor/sensitivity to 0.1 µemu at 16.2 mm (0.64 in) air gap, corresponding to <3.5 mm (0.14 in) sensing coil gap, and 10 s/pt averaging
• Variable magnet air gap permits magnet/coil adjustments to suit samples and provide field strengths to 21.7 kOe while only occupying 8 square feet of space
• Water-cooled magnet coils provide excellent field stability when high power is required to achieve the maximum field capability
• Bipolar power supply provides smooth continuous transition through zero field
• Fast data acquisition – average sample run (hysteresis loop) over full field range typically requires only minutes
• Computer-automated data collection system with Windows® NT/2000 menu driven color graphic software for system operation, data acquisition, and analysis. System software includes operation and control of the magnet power supply, VSM control unit, and gaussmeter. Real-time feedback of processed magnetic moment measurement data can be displayed in either graphical or tabular format.

System Specifications

General

| Moment Measurement range | 0.1 × 10^{-6} emu to 1000 emu |
| Time constants (TC) | 0.1 s, 0.3 s, 1.0 s, 3.0 s, or 10.0 s |
| Output stability | Better than ±0.05% of full scale per day for fixed coil geometry at constant field and temperature |
| Absolute accuracy | Better than 1% of reading ±0.2% of full scale (when test sample and calibrant are geometrically identical) |
| Reproducibility | Better than ±1%, or ±0.15% of full scale, whichever is greater, fixed rotation angle |
| Field accuracy in gauss | 1% of reading or ±0.05% of full scale |

Performance Specifications

| Magnet pole face diameter | 51 mm (2 in) |
| Coil set | 740EMSC – 1 in mini pickup coils |
| Magnet air gap range | Minimum Maximum |
| | 16.2 mm (0.64 in) 38.1 mm (1.5 in) |
| Sample access | <3.5 mm (0.14 in) <25.4 mm (1.0 in) |
| Magnetic field | 21.7 kOe 11.8 kOe |

Noise Floor/Sensitivity at 16.2 mm operating air gap

0.1 µemu at 0.1 s TC, 10 s/pt averaging
0.4 µemu at 0.1 s TC, 1.0 s/pt averaging
0.75 µemu at 0.1 s TC, 0.1 s/pt averaging
Equipment

Model 736 VSM Electronics with integrated gaussmeter
- **Resolution**: ±1 part out of 300,000
- **Precision**: Up to 0.0007% of full scale for 350 G and above ranges

Model 740EMSC mini pick-up coils
Model 731 Mechanical VSM head drive assembly and mounting structure
Instrumentation console

Model EM4-HV Variable Gap Electromagnet
- **Pole diameter**: 102 mm (4 in)
- **Pole face diameter**: 51 mm (2 in)
- **Cooling water requirements**: Tap water or closed cooling system (optional chiller available)
- **Flow rate**: 3.8 L/m (1 gal/min) at 45 to 75 psi

Model 662 Bipolar Power Supply
- **Maximum output**: ±70 A / ±35 V / 2.4 kW
- **AC line input; current draw**: 208/220 VAC, 50-60 Hz; 12 A
  - 380/400 VAC, 50-60 Hz; 6 A
- **Power consumption**: 4.5 kVA
- **Cooling water requirements**: Tap water or closed cooling system, between +15 °C to +24 °C
- **Flow rate**: 6 L/m (1.6 gal/min) at 45 to 75 psi

Model 740927 Sample tail kit
- (1) 740933: One-piece fiberglass, 3.5 mm air gap, thin-film side
- (1) 740934: One-piece fiberglass, 3.5 mm air gap, thin-film bottom
- (1) 740935: Sample tail only, fiberglass
  - (3) 730931: Bulk/Powder upper and bottom sample cup, Kel-F
  - (3) 730933: Thin-film side sample holder, Kel-F
  - (3) 730934: Thin-film bottom sample holder, Kel-F
(Liquid holders are purchased separately)

Computer

VSM Software
Windows™ NT/2000 menu driven, enhanced color-graphic software for system operation, data acquisition and analysis. System software includes operation and control of the magnet power supply, VSM control unit, and gaussmeter. Real-time feedback of processed magnetic moment measurement data can be displayed in either graphical or tabular format.

Printer
HP InkJet printer

Shipping weight
Three (3) crates totaling 903 kg (1990 lb)