

Model 7404

Vibrating Sample Magnetometer

Introduction

Lake Shore's 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, sputtered and plated thin film materials including multilayer GMR, CMR, exchange-bias and spin valve materials. A magnetoresistance option allows for fast and accurate resistance measurements of materials as a function of temperature and field.



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
- Magnetoresistance measurements as a function of field and temperature (to 673K) with MR option

Materials

All types of magnetic materials:

- Diamagnetic, Paramagnetic, Ferromagnetic, Ferrimagnetic, Antiferromagnetic materials 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

- Computer-automated data collection system providing field strengths to 14.5 kG while only occupying 8 square feet of space
- Measurement of moments as small as 0.5×10^{-6} emu in magnetic fields ranging from -14.5 to +14.5 kG
- Adjustable magnet air gap permits adjusting magnet/coils to suit sample and field strength requirements
- 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
- 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.
- Water cooled magnet coils provide excellent field stability when high power is required to achieve the maximum field capability

System Specifications

General

Magnetic Moment

Dynamic range	0.5×10^{-6} emu to 10^3 emu
Noise	0.5×10^{-6} emu at 1.0" gap
Time constants	0.1 second, 0.3 second, 1.0 second, 3.0 seconds, or 10.0 seconds
Output stability	Better than $\pm 0.05\%$ of full scale per day for fixed coil geometry at constant field and temperature
Absolute accuracy	Better than 2% of reading $\pm 0.2\%$ of full scale
Reproducibility	Better than $\pm 1\%$, or $\pm 0.15\%$ of full scale, whichever is greater
Gaussmeter ranges	300 G, 3 kG, 30 kG, 300 kG
Field dynamic range	0.05 Gauss to 300 kG
Field noise in gauss	0.05 G for high stability probe HST (High Stability Probe)
Field accuracy in gauss	1% of reading or $\pm 0.05\%$ of full scale
Field stability in gauss	$\pm 0.05\%$ of full scale
Maximum field strength	± 14.5 kG (standard configuration with air gap of 2.3 cm (0.9") 10 kG @ 1.6" gap
Shipping weight	Three (3) crates totaling 352 kg (775 lbs)

*Allow 216 cm (85") ceiling clearance from the center of the magnet for removing sample rod assembly.

Equipment

Lake Shore Model 7404 consisting of:

Model 736 VSM Electronics with integrated gaussmeter

Resolution	± 1 part out of 300,000
Ranges	Seven ranges from 300.000 mG to 300.000 kG full scale ranges
Precision	Up to 0.0007% of full scale for 300 G and above ranges
Hall probe	HST ± 300 kG

Model 730EMSC mini pick-up coils

VSM head assembly and mounting structure
Instrumentation console

Electromagnet Model EM4-HV (Variable Gap)

Pole diameter	10.2 cm (4")
Pole face diameter	5.1 cm (2")
Cooling water requirements	Tap water or closed cooling system (opt. chiller available)
Flow rate	1 gallon per minute (4 liters/minute)

Model 662 Bipolar Power Supply

Maximum output	±35 volts/±70 amps (2.4 kW)
AC line input	208/220/380/400 VAC, 50-60 Hz
Cooling water requirements	Tap water or closed cooling system (opt. chiller available)
Flow rate	1.7 gallons per minute (6 liters/minute) +11 °C to +25 °C

Sample holders (3 of each holder supplied)

Powder	3 mm (0.13") diameter x 6.35 mm (0.25") long
Thin-film bottom	6.35 mm (0.25") diameter
Thin-film side	6.35 mm (0.25") long x 12.7 mm (0.5") wide
Liquid (purchased separately)	3 mm (0.13") diameter x 6.35 mm (0.25") long; nominal volume 100 µl

Computer

700 MHz Intel processor, 64 Meg of RAM, hard drive, 3.5" 1.44 MB floppy drive, CD-ROM, 17" SVGA color monitor with 1024x768 resolution, Windows™ NT/2000, and National Instruments PCI-GPIB IEEE-488 interface.

IDEAS™ 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.

HP InkJet printer

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