

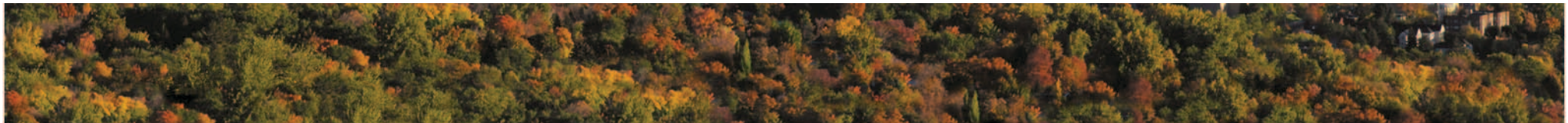


# The Nanofab's Vibrating Sample Magnetometer (VSM)

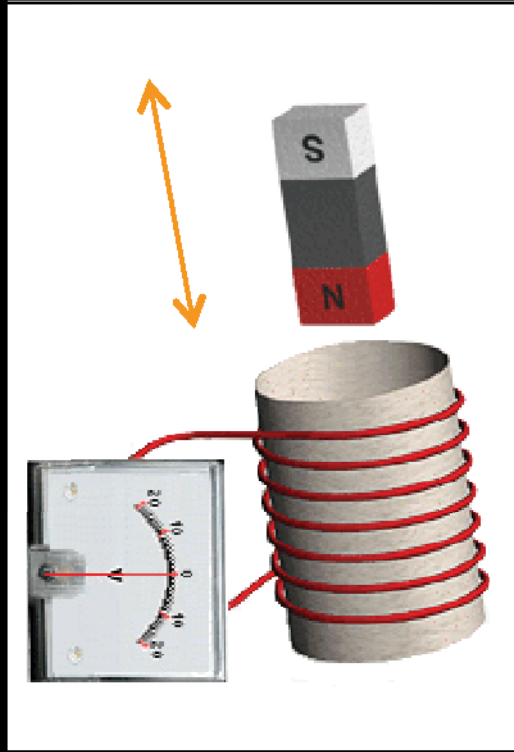
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# Our vibrating sample magnetometer (VSM)



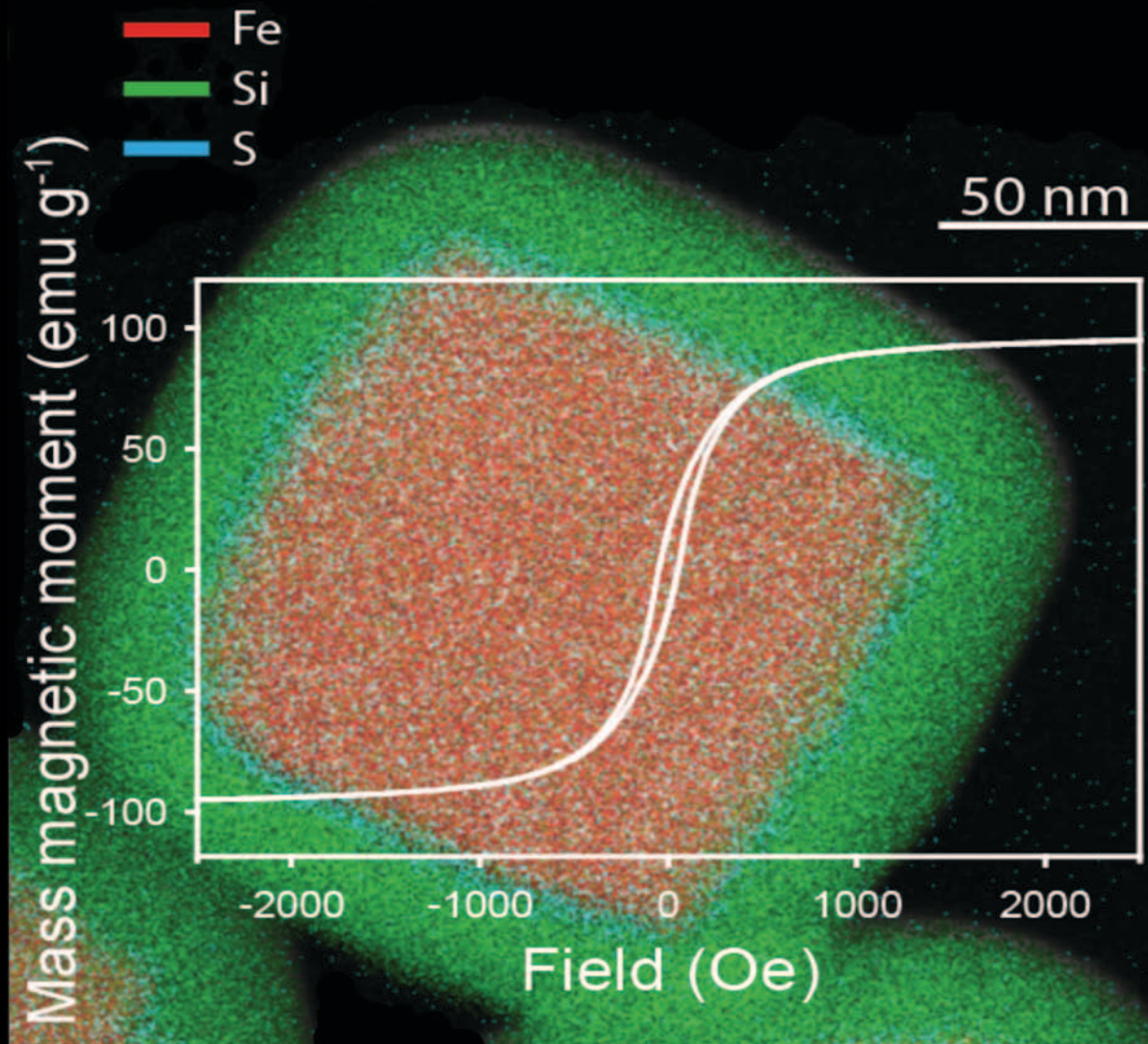
$$\varepsilon = -N \frac{d\Phi_B}{dt}$$



# Typical goals of VSM measurements

Measure magnetization (M) or magnetic moment (m) as a function of:

- Magnetic Field (H,  $\text{A m}^{-1}$ , Oe); Field Angle; Sample Temperature



# What can our VSM do for you?

- Measure magnetic moment of planar and powdered samples.
- Measurements can be performed between  $-170^{\circ}\text{C} < T < +720^{\circ}\text{C}$ .
- The system is equipped with a linear 4-point probe for magnetoresistance measurements of thin films at temperatures between  $0^{\circ}\text{C}$  and  $+720^{\circ}\text{C}$ .

## EV7 Vibrating Sample Magnetometer - Specifications

### MAGNETIC FIELD

#### Maximum Field

With sample space of 5mm:	2.15T
With sample space of 10mm:	2.0T
With oven/cryostat:	1.75 T
With Vector Option:	1.75 T
With Torque Option (with VSM coils in place)	2.0 T
With Torque Option (with VSM coils removed)	2.4 T

#### Field Resolution and Noise

Range	Resolution	Noise
32 Gs	0.001 Gs	5 mGs
320 Gs	0.01 Gs	10 mGs
3.2 kGs	0.1 Gs	15 mGs
32 kGs	1 Gs	15 mGs

### MAGNETIC MOMENT

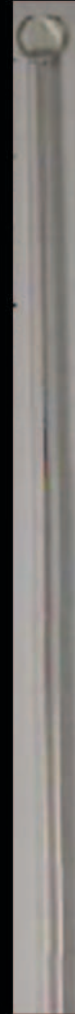
Dynamic range	0.1 $\mu\text{emu}$ – 100 emu (extendable to 1000 emu)		
Signal ranges	1, 2, 5, 10, 20 .... $\mu\text{emu}$ – 1000 emu		
Accuracy	$\pm 1\%$ + noise if sample and calibration standard are equal in shape and size.		
Repeatability	$\pm 0.5\%$ + noise (Typical: 0.1%) at constant room temperature		
Drift	0.05% RMS of full scale Measured over 48 hours at constant field and room temperature		
Noise (0.1 s T.C.)	5 mm sample space	10 mm sample space	with EV1-LNA
1 avg.	1 $\mu\text{emu}$	1.5 $\mu\text{emu}$	2.5 $\mu\text{emu}$
30 avg.	0.5 $\mu\text{emu}$	1 $\mu\text{emu}$	1.5 $\mu\text{emu}$
100 avg.	0.1 $\mu\text{emu}$	0.3 $\mu\text{emu}$	0.5 $\mu\text{emu}$

# Sample holders

8-mm perpendicular



5-mm perpendicular



8-mm transverse



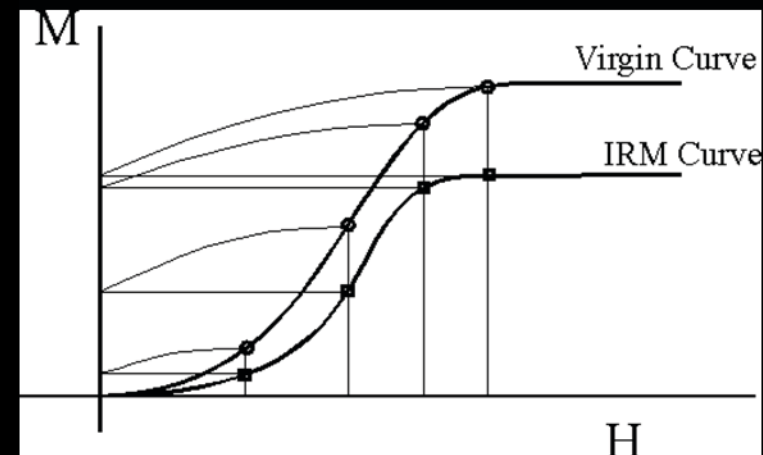
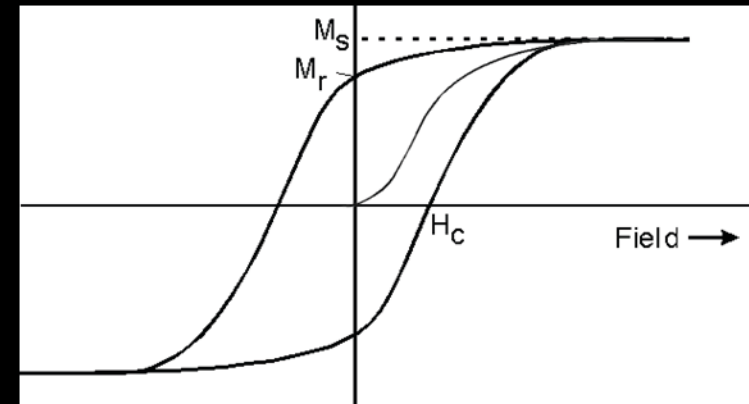
5-mm transverse



Powder  
cup

# Measurement types

- Magnetic hysteresis loops;
- Virgin remanent magnetization;
- Saturation magnetization; Coercivity;
- DC-demagnetization remanence;
- angular remanence; AC-remanence;
- First-order-reversal curves;
- Isothermal remanent magnetization; and
- Temperature scan.



# Acknowledgements



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