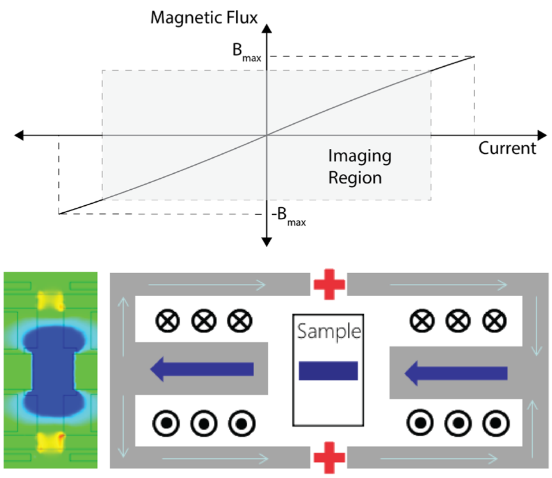
TEM Magnetizing

Technical Specs

	1700 Series
Tilt Range	Up to ±45° depending on objective pole
Sample Size	1x2mm
In-plane applied magnet-ic flux density	Up to 900 Gauss, depending on microscope and pole piece
Electron imaging	From -300 Oe to +300 Oe applied field
Beam Deflection	Integrated passive magnetic compensation
TEM Compatibility	FEI, JEOL, Hitachi
Wiring	Standard or low-noise shielded
TEM Compatibility	FEI, JEOL, Hitachi

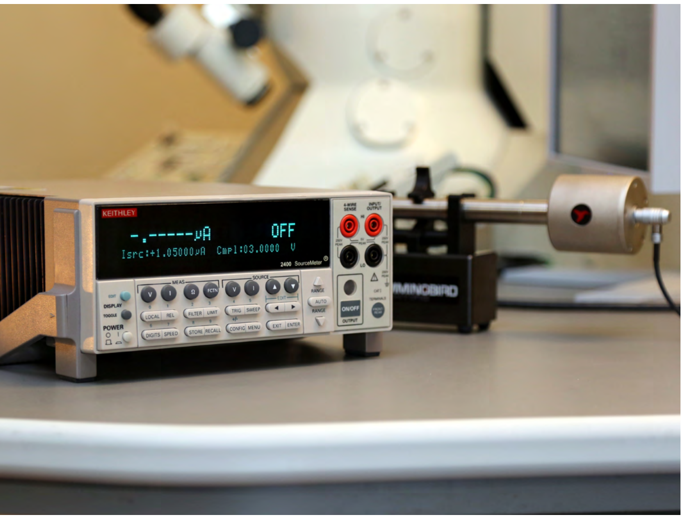
How It Works



Using in-plane magnetic fields, Hummingbird Scientific's magnetizing holder can apply up to +/- 900 Gauss to the sample area. The system uses a built-in magnetic compensation circuit to limit the magnetic effect on the electron beam, increasing image quality and the maximum usable magnetic field (+/- 300 Oe). The field is quantified and calibrated at the sample via a miniature field sensor.

Left: (Top) Graph illustrating the maximum applied magnetic field and the maximum field at which imaging is possible. (Bottom) Schematic showing the magnetic field lines for negative applied field. The magnetic compensation circuit guides the field around and applies an opposite field above and below the sample position. Colored image to the left shows FEA results of the magnetic fields at the sample.

Accessories



Accessories available for your magnetizing holder:

- 1 x 2mm SiN Sample Substrates
- Keithley 2400 SMU (pictured)
- Vacuum Tip Cover

Available For

FEI — TECNAI/TITAN/CMX00 SUPER TWIN, X-TWIN, ULTRA-TWIN

JEOL — 2010/2100/ARM, HR/ARP POLE, URP/UHR POLE, GRAND ARM

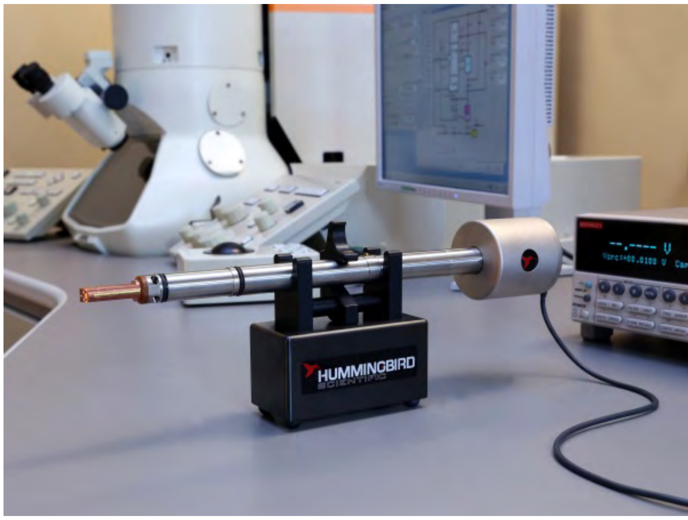
HITACHI — HITACHI

Product Summary

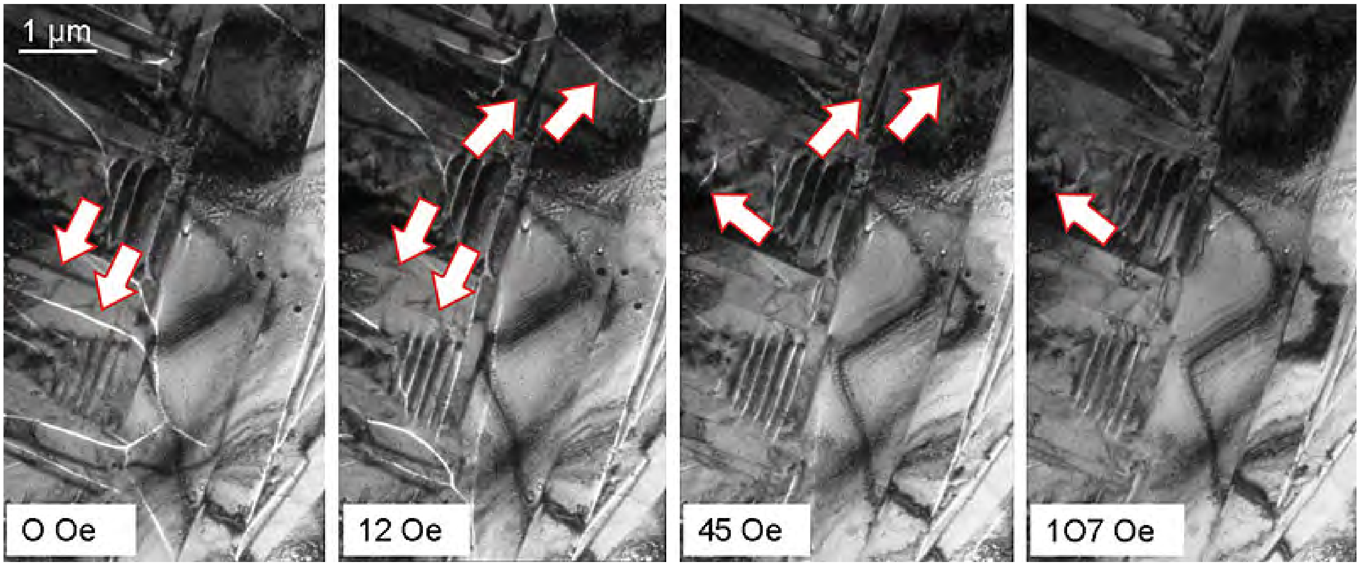
Using Hummingbird Scientific's magnetization holder, scientists can explore how magnetic materials and devices respond dynamically to applied in-plane magnetic fields. Specific applications include studies of the physics of functional magnetic and multiferroic materials such as magnetic alloys, complex oxides, giant/colossal magnetoresistance materials and nanoscale magnetic structures. The magnetization holder is also available in a high-performance version for the JEOL LTEM.

Sample Applications:

- Directly visualizing magnetic domain switching
- Observing microstructure interactions with domain-wall motion
- Correlating bulk measurements with nanoscale processes



Application Example



Magnetic Thin Film Materials

In combination with magnetic TEM imaging techniques (e.g. Lorenz TEM), the in-situ application of magnetic fields to magnetic materials allows researchers to study nano-scale magnetic behavior and directly correlate material microstructure with magnetic domain structure.

Above: Fe-Pd alloy film showing changes to magnetic domain structure as a function of the in-plane magnetic field applied using magnetizing holder. Magnetic domain walls appear as white and black line pairs. Marc De Graef, Carnegie Mellon University; images courtesy of Amanda Petford-Long, Argonne National Laboratory. (ANL, a U.S. Dept. of Energy, Office of Science Laboratory, is operated under Contract No. DE-AC02-06CH11357).

Reference: M. De Graef, **"Recent Progress in Lorentz Transmission Electron Microscopy",** EPJB Condensed Matter and Complex Systems, ESOMAT 2009, 01002, 2009 (Section 2). Abstract

Selected Publications

A. Budruk, C. Phatak, A.K. Petford-Long, M. De Graef. **"In-situ Lorentz TEM magnetization studies on a Fe-Pd-Co martensitic alloy,"** Acta Materialia 59:17 (2011) pp. 6646-6657

A. Budruk, C. Phatak, A.K. Petford-Long, M. De Graef, **"In-situ Lorentz magnetization study of a Ni-Mn-Ga ferromagnetic shape memory alloy,"** Acta Materialia 59:12 (2011) pp. 4895-4906

M. De Graef. **"Recent Progress in Lorentz Transmission Electron Microscopy,"** 8th European Symposium on Martensic Transformations (2009), Keynote Lecture

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