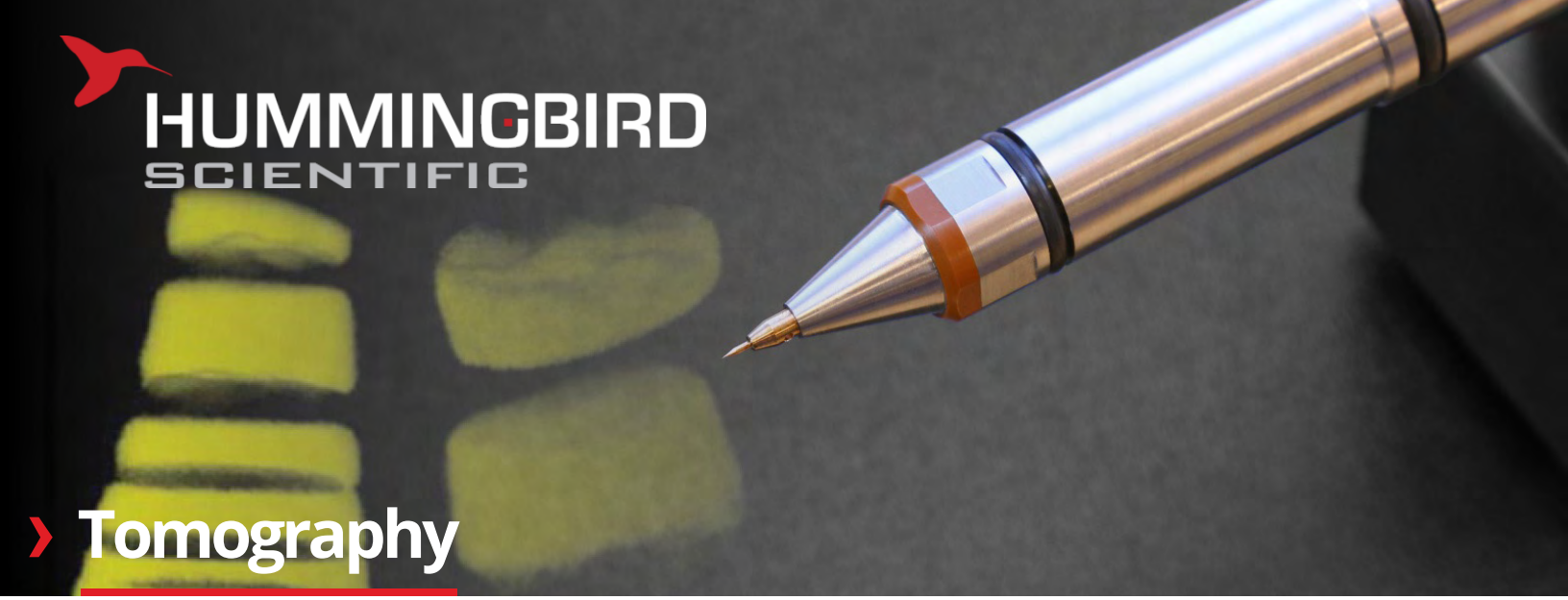


HUMMINGBIRD SCIENTIFIC

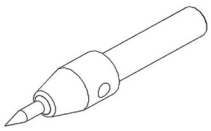
Tomography

Technical Specs

	1000 Series
Removable tips for varying sample sizes	Single Point Needle, 1mm Grid, 3mm Half-Grid, 3mm Full-Grid
Tilt Range	±90° (dependent on stage limits)
Image Resolution	Down to microscope specification
TEM Compatibility	FEI, JEOL, Hitachi, Zeiss

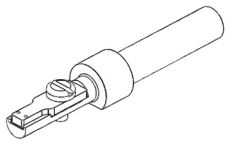
Sample Tip Options

The removable tip allows for correlative imaging between the TEM and the atom probe because the same tip and sample can be loaded into both microscopes. The removable sample tips can also be directly loaded into FIB/SEM for easy sample preparation.



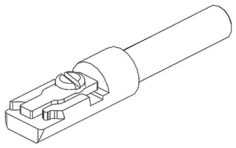
Single Point Tip

The single point tip is a dedicated sample holder for needle samples. These nanometer scale needles are typically FIB cut from material directly deposited onto the removable tip. The single-point tip ensures that researchers full view of needle samples following alpha tilt up to any stage tilting limit.



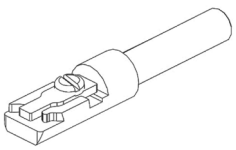
1mm Grid Tip

The 1mm sample tip clamps a custom 1mm sample geometry for high-tilt tomography applications in narrow, gap-objective lens microscopes.



3mm Half Grid Tip

Because this tip was specifically designed for holding TEM half-grids, the sample clamp does not provide any shadowing of the sample, which ensures high quality tomography data. Half grids can be used for standard FIB lift-out samples as well as multiple-needle samples.

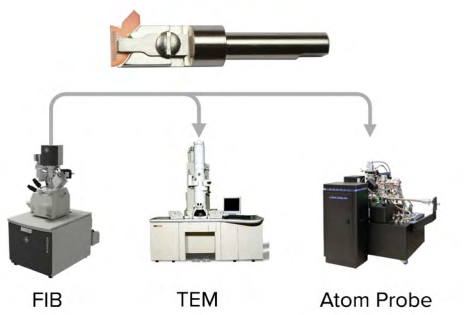


3mm Full Grid Tip

The 3mm full grid tip clamps a standard 3mm TEM sample with minimal shadowing at high alpha-tilt angles.

Atom Probe Tomography Workflow

One sample on one tip: using our TEM tomography holder system in combination with a Focus Ion Beam (FIB) and Atom Probe (AP), researchers have a comprehensive, cross-correlative view for 3D sample reconstruction at the atomic and nano scale. The sample is first sectioned out to the required size and shape using the FIB. The sample can then be left on the same tip and transferred to the TEM for final shape verification and tilt-series acquisition before being placed in the Atom Probe for final analysis.



Accessories

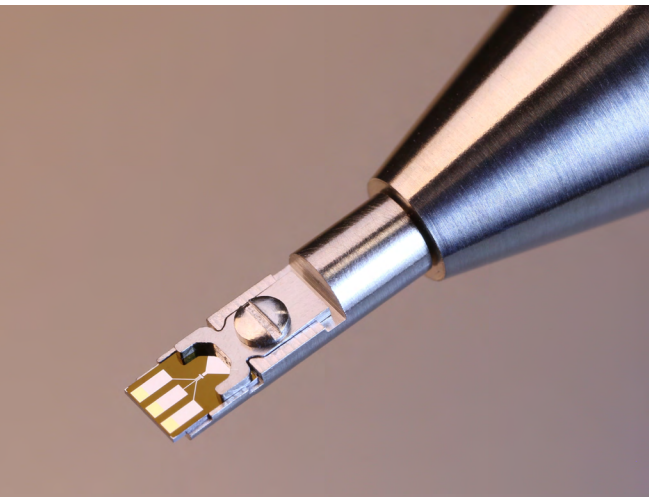
Accessories available for your tomography holder include:

- 1mm Square Grids
- 1mm L-Grids
- 3mm Tabbed Grids
- Half-Grid Setup Block
- Full-Grid Setup Block

Available For

FEI — TECNAI/TITAN/CMX00 SUPER TWIN, X-TWIN, ULTRA-TWIN	HITACHI — HITACHI
JEOL — 2010/2100/ARM, HR/ARP POLE, URP/UHR POLE, GRAND ARM	ZEISS — ZEISS

Product Summary



Hummingbird Scientific's single-tilt tomography holder tips are designed for cross platform transfers. Because the system permits unusually high tilt angles, the sample itself is the only contributor to the missing wedge. A range of removable tips are available for the system and can be customized for specific specimen support geometries.

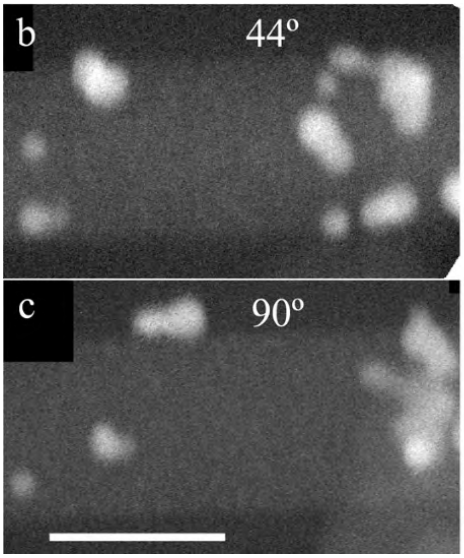
Sample Applications:

- 3D reconstruction of embedded biological specimens
- 3D reconstruction of nanostructures and embedded structures such as dislocations and precipitates
- Correlative comparisons between TEM and atom probe tomography
- Post-mortem analysis of chips used in fluid and gas experiments

Application Example

Nano-wire Characterization using TEM Tomography

Researchers at Northwestern University have used Hummingbird Scientific's tomography holder to characterize Au-catalyzed nano-wires and map the spatial distribution of Au on Si nanowires. Au nanoparticles attached to Si nanowire devices significantly enhance the photocurrent via local surface plasmon excitation of the nano-wire. A complete understanding of nanoscale structure property relationships in such materials requires a 3D perspective with sub-nanometer resolution.



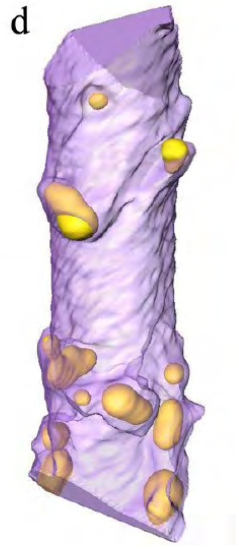


Figure Left (b, c): Dark Field STEM images of a nanowire tilted at different angles. Scale bar is 50 nm.

Figure Right (d): 3D reconstruction of Au particle distribution on Si nano-wires.

Reference: J. Wu, S. Padalkar, S. Xie, E.R. Hemesath, J. Cheng, G. Liu, A. Yan, J.G. Connell, E. Nakazawa, X. Zhang, L.J. Lauhon, V.P. Dravid. **"Electron Tomography of Au-Catalyzed Semiconductor Nanowires,"** Journal of Physical Chemistry C 117:2 (2013) pp.1059-1063.

Selected Publications

A. K. Shukla, P. Ercius, A. R. S. Gautam, J. Cabana, and U. Dahmen **"Electron Tomography Analysis of Reaction Path during Formation of Nanoporous NiO by Solid State Decomposition."** Crystal Growth & Design 14, (2014) 2453–2459

M. Ge, Y. Lu, P. Ercius, J. Rong, X. Fang, M. Mecklenburg, and C. Zhou **"Large-Scale Fabrication, 3D Tomography, and Lithium-Ion Battery Application of Porous Silicon"** Nano Letters 14 (1), (2014) 261-268

J. Wu, S. Padalkar, S. Xie, E.R. Hemesath, J. Cheng, G. Liu, A. Yan, J.G. Connell, E. Nakazawa, X. Zhang, L.J. Lauhon, V.P. Dravid. **"Electron Tomography of Au-Catalyzed Semiconductor Nanowires,"** J. Phys. Chem. C 117:2 (2013) pp.1059-1063

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