OmniProbe 400

The ultimate “all-in-one” nanomanipulator

Optimised for nanometre accuracy and high-speed

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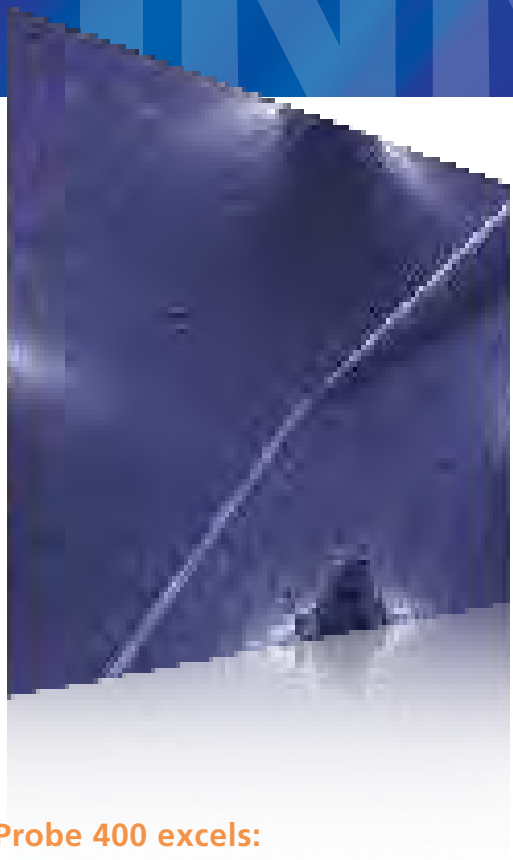
OmniProbe 400

The most capable and easy to use *in situ* nanomanipulator...



OmniProbe 400

A new generation of nanomanipulator, the OmniProbe 400 exploits innovative piezo actuation for best in class nanoscale positioning.

Optimised for maximum flexibility and performance, the OmniProbe 400 is the ultimate nanomanipulator for high resolution and high throughput applications.

Unlike any other manipulator, the OmniProbe 400 provides closed loop motion in 4 degrees of freedom as standard: *in situ* tip exchange and tip sharpening are now easy for any user.

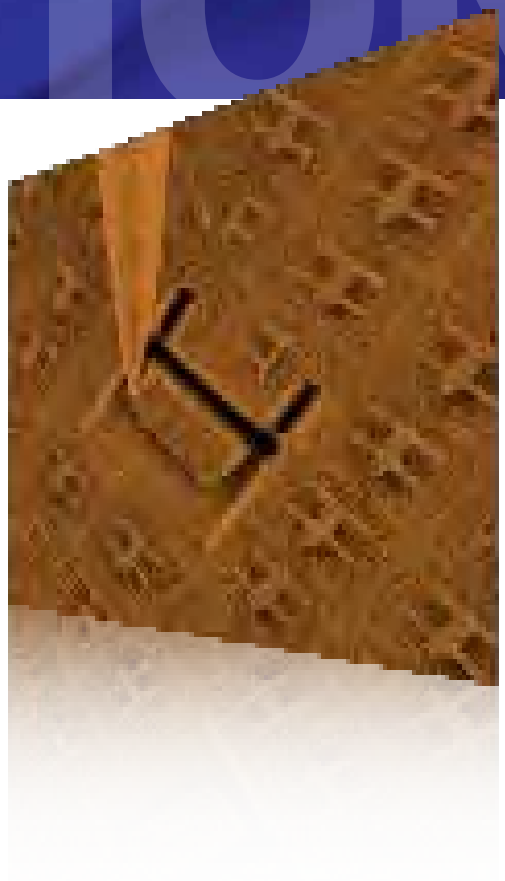
Ideal for nano-object manipulation

Where the OmniProbe 400 excels:

- Manipulate precisely at the nanoscale with 4mm travel
- Move nanoparticles and nanowires into specific patterns and test structures
- Measure electrical parameters of nanostructures
- High throughput TEM lift-out, plan-view, backside and atom probe sample preparation
- Neutralise charge on uncoated samples
- Microdissection of biological samples
- Improve microanalysis by isolating the sample
- Streamlines workflow and scheduling in multi-user labs

OmniProbe 400

...optimum system performance



Benefits

- **Accuracy**: Nanometre-resolution piezo actuators and closed-loop encoders provide industry-leading precision, linearity and smooth motion
- **Speed**: Automation on multiple levels enables results in the fewest steps possible
  - Insertion repeatability eliminates tip realignment
  - Change tips in 3 minutes without venting
  - Concentric rotation enables rapid tip sharpening, tip cleaning, and sample repositioning
  - Safely and precisely navigate to stored positions close to the sample and back to park
- **Resolution**: The port-mounted design allows sub-nanometre positioning while the sample is at working distances as short as 4mm
  - In situ tip changes preserve chamber vacuum and cleanliness for maximum imaging resolution.
- **Flexibility**: This system builds on all of the strengths of OmniProbe lift-out to provide a complete solution for manipulation at the nanoscale
- **Stability**: The absence of mechanical resonances at critical frequencies provides stability even in demanding environments

OmniProbe 400

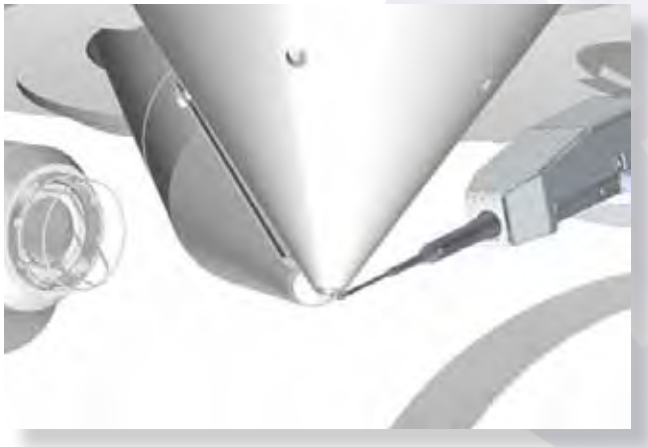
Superior hardware design...

Combining accuracy and flexibility, the sub-nanometre resolution of the OmniProbe 400 is ideal for nanomanipulation as well as in situ lift-out sample prep. It provides a low cost-of-ownership through automation, precision, and ease of use.

Port-mounted

Once installed it remains ready to use at a moment's notice.

- Out of the way when not needed
- Compatibility with a wide array of microscope accessories
- Stage-independent motion



Integrated coarse and fine motion

Coarse and fine motion in the same actuator allows smooth transitioning from coarse long moves to fine steps at maximum precision.

- Velocity control achieves fast moves over long distances, or slow moves for nanoscale navigation
- Step control provides efficient and precise navigation over a specific distance

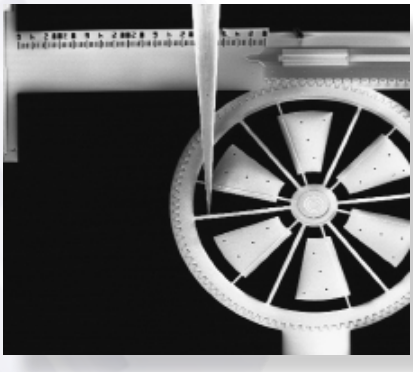
Linear motion in 3D space

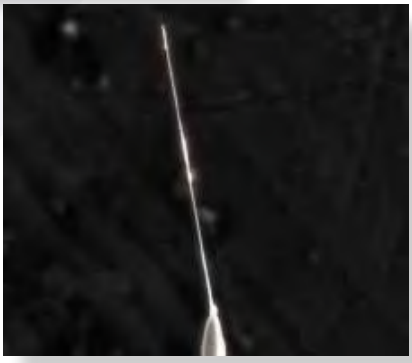
Automation of all three axes enables simple and intuitive navigation, regardless of hardware configuration.

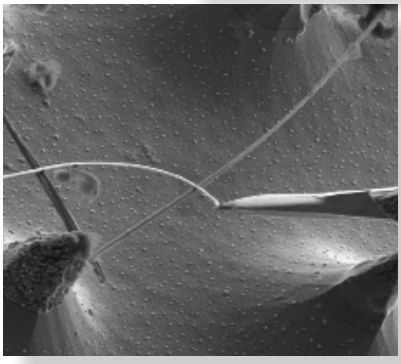
- Move in a straight line in any direction
- Navigate by Cartesian coordinates
- Compound axes control enables motion normal to the stage at any degree of tilt

OmniProbe 400

....optimum system performance







4^3 Performance

Concentric rotation

The tip stays in the field of view for rapid tip shaping and sample reorienting without risk of sample loss or accidental venting

- Position with sub-degree accuracy
- Extend the needle life
- Create fine tips exhibiting ohmic behavior
- Prepare microtips for nanoparticle manipulations that use Van der Waals forces
- Reorient samples for plan-view, side-view and backside preparations

Accurate closed-loop feedback control

The OmniProbe 400 uses 10 nm closed-loop control to deliver smooth motion and dependable accuracy.

- Move with high accuracy, linearity and repeatability
- Move predictably on any port
- Always know where the probe tip is, even when outside the field of view
- Move diagonally in any direction
- Navigate orthogonally at any sample tilt
- Rotate concentrically
- Use fixed and user-programmable positions
- Avoid collisions
- Change tips in situ

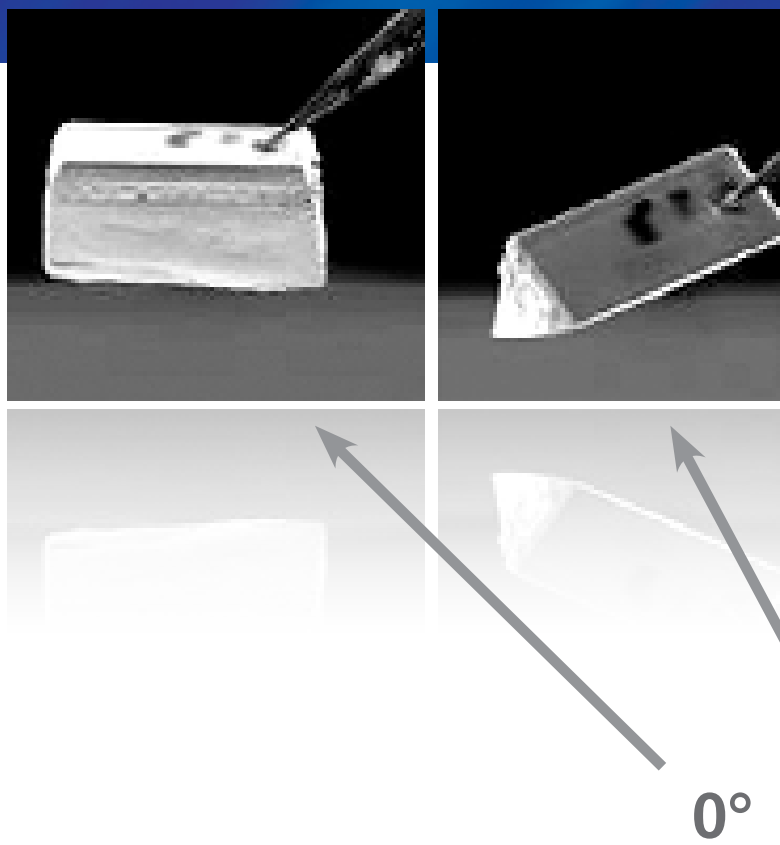
4^3 performance

Nanoscale manipulation and testing in the SEM and varied lift-out TEM sample preparations in the FIB can be performed easily while using optimized working distances

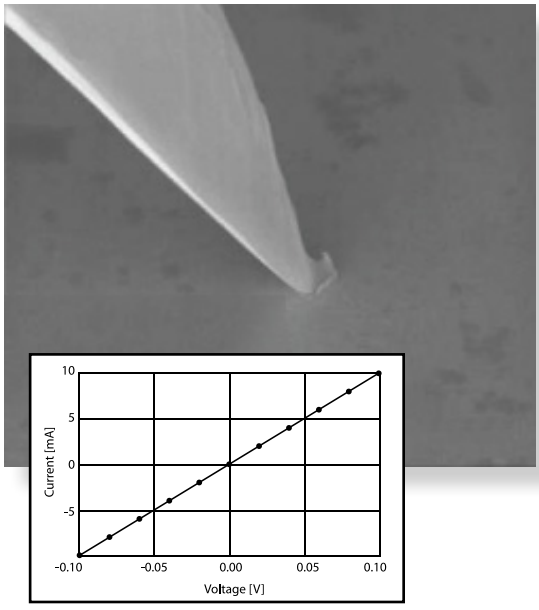
- **4** degrees of freedom (X,Y,Z,R)
- **4** mm or more working distance
- **4** motion strengths: encoder resolution, motor resolution, repeatability, linearity

OmniProbe 400

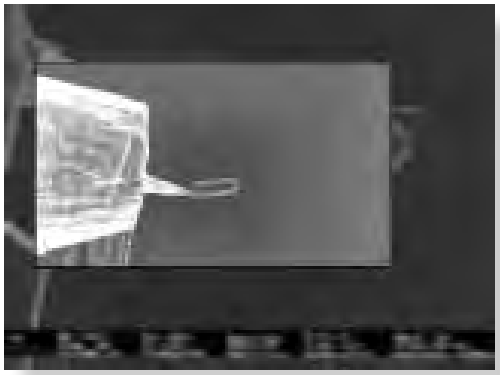
Concentrically-corrected rotation axis



Achieve ohmic contact



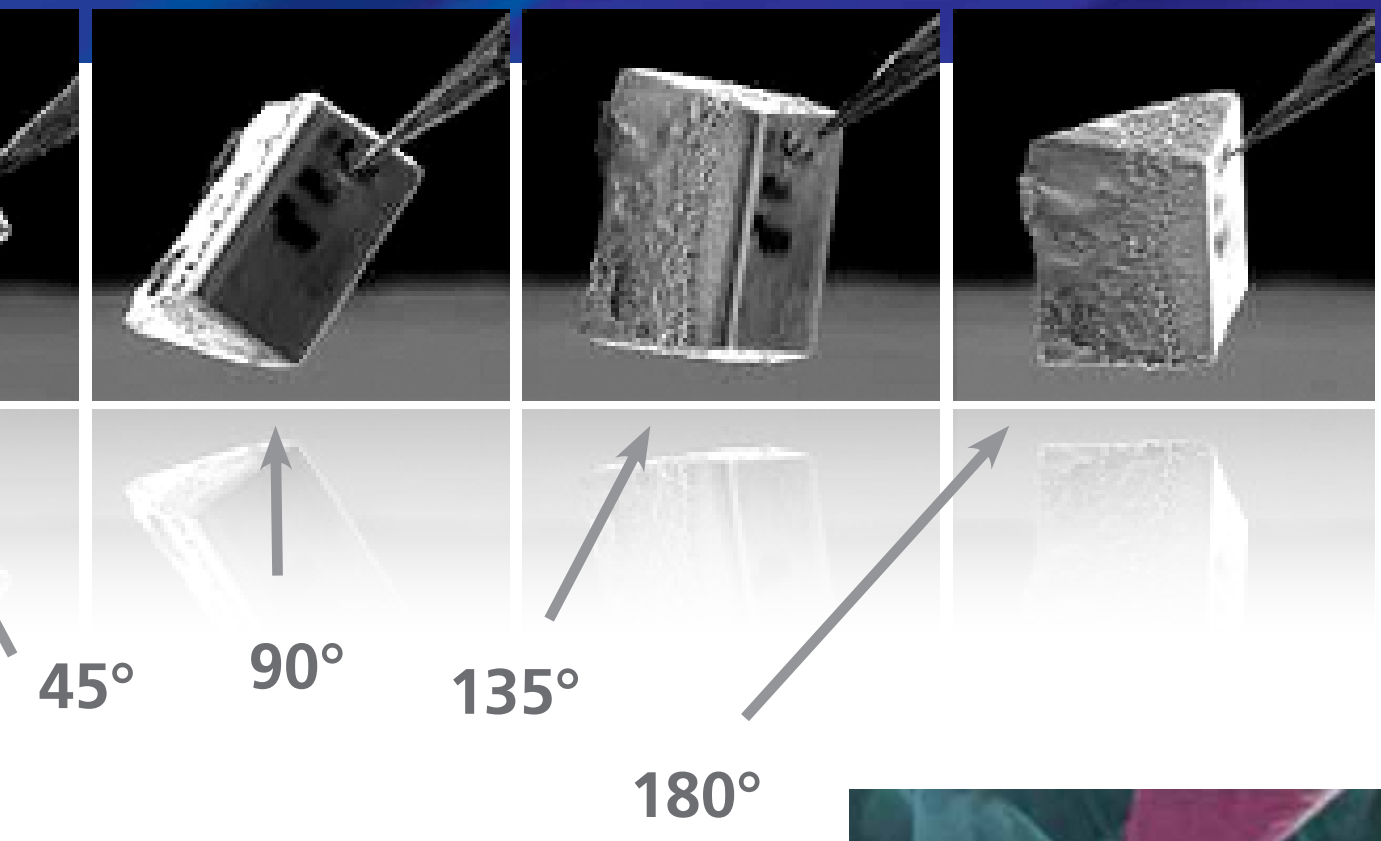
FIB-sharpened tips improve ohmic contact by removing oxide and contamination



Sharp tips enable particle pick-up using Van der Waals forces

Create 20 nm tip radii

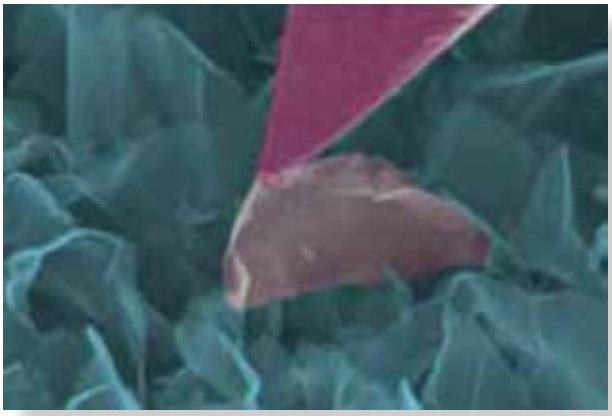
PLICATIONS



Use rotation for improved results

Concentric rotation enables rapid tip sharpening

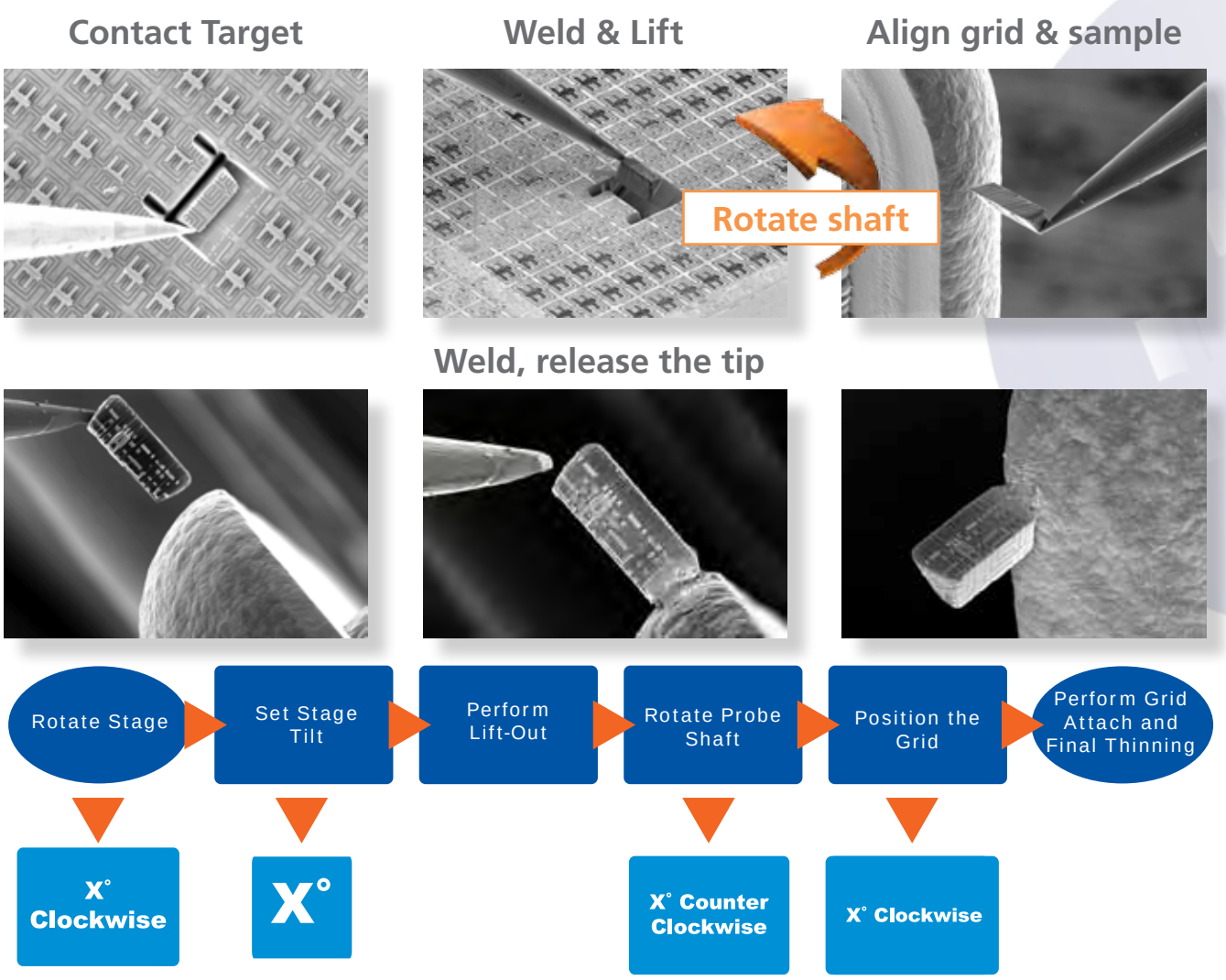
- Create <20nm tip diameters for interaction with nano samples
- FIB-sharpened tips exhibit ohmic properties, improving electrical measurements
- Ultra-sharp tips can exploit Van der Waal's manipulation strategies
- Refresh used tips
- Rotate precisely using 0.1° resolution
- View the tip during rotation at magnifications up to a 60 micron horizontal field of view
- Rotate safely without risk of colliding with something off-screen



- Nano-object electrical tests use a source-measure unit connected to both the manipulator tip and the sample
- Contact is made while imaging at 80,000x magnification
- Resistance vs voltage measurements are acquired

Make analytical samples

Plan-view TEM samples in under an hour



"X" is calculated from an algorithm that considers the manipulator's mounted position. The values will vary across different equipment installations.

Plan-view operations

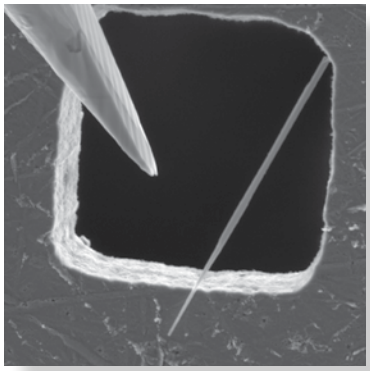
Integrated rotation and proprietary process flows rapidly orient samples

- Requires one lift-out step
- No extra accessories needed
- No venting in the process
- Sample target areas can be lifted and moved to plan-view positions in <20 minutes

Manipulation in the SEM

Move nanowires to build atom probe specimens

1



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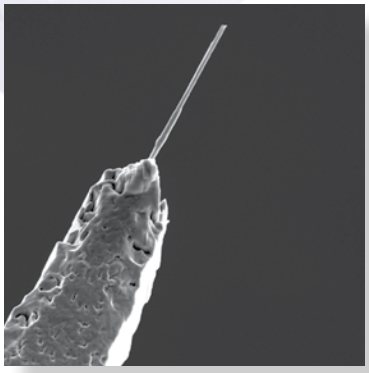
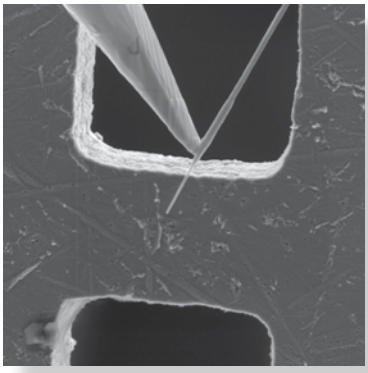


GaN nanowire preparation for atom probe tomography

- Manipulation and transfer is achieved using only the electron beam
- Attachment is obtained by a Pt-deposited nanoweld
- The nanowire is lifted by moving the probe tip until tensile forces exceed the attachment strength
- This process is repeated to attach the nanowire to the atom probe holder and to seperate the tip from the nanowire

2



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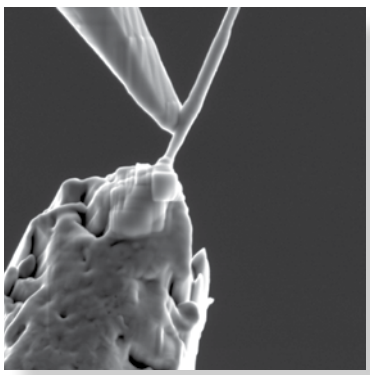

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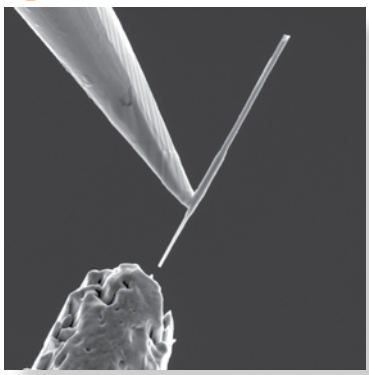
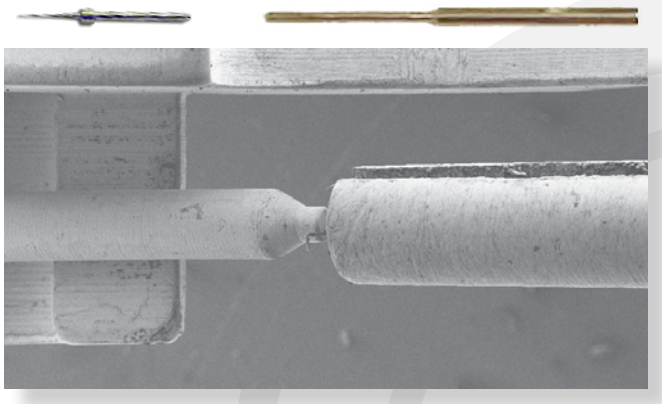


In situ tip exchange

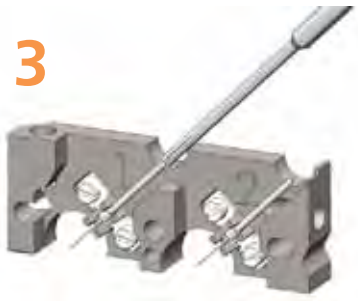
Automation improves efficiency and preserves chamber vacuum

Benefits

- Probe needles can be replaced in under 3 minutes without venting the microscope
- Atmospheric contamination is avoided and the high vacuum preserved for the best performance
- Samples attached to tips can be safely stored for later use, allowing multiple users to maintain their throughput



Change tips in under 3 minutes!

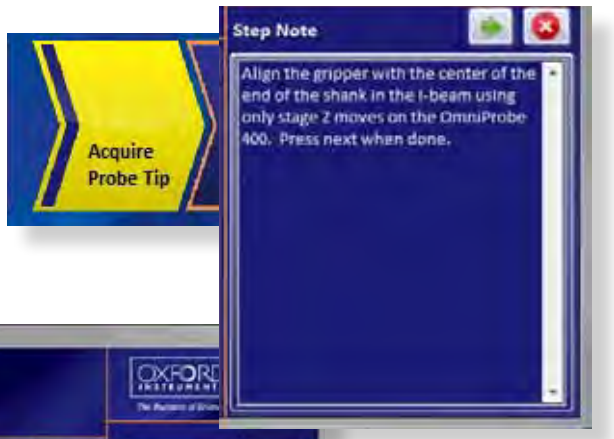


Intuitive software interface

Intuitive software

Laboratories have unique requirements, and different analysts have different levels of experience. The software provides everyone with the ability to create customised notes.

- Ideal for novice or infrequent users as well as seasoned experts
- Use to describe analytical considerations, such as sample preparation or optimum SEM conditions
- Step notes can be tailored to specific operating procedures



Each navigator step is accompanied by step notes incorporating on screen help and images

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