Project Plan Feature in AP Suite

Streamline Your Entire Atom Probe Analysis Workflow

When performing atom probe tomography in a high throughput environment, a high degree of automation or consistency across experiments is a benefit. The Project Plan feature in AP Suite, shown in Figure 1, allows the user to semi-automate steps throughout the entire workflow. Recipes can be created to pre-define parameters for acquisition, reconstruction, and data analysis, so less user time is spent completing routine experiments and preliminary data processing.

The user can create three types of recipes: acquisition, reconstruction, or analysis.



- **Acquisition Recipes** pre-define the parameters in the ACC instrument control software. After creating a recipe, use Project Plan to add it to the project, and then assign it to individual specimens, or set it as the default recipe to automatically assign it to all specimens created for that project. The recipe will automatically be loaded when the specimen is moved to the analysis chamber.
- **Reconstruction Recipes** include the same settings available in the Reconstruction Wizard. Using a Reconstruction Recipe is a method to consistently and efficiently reconstruct specimens. The Reconstruction Recipe will also be applied to the live 3D reconstruction during an acquisition.
- **Analysis Recipes** allow features to be automatically calculated and displayed for review in the Data Navigator without ever opening the reconstruction. For example, an Analysis Recipe can be used to calculate the bulk composition of multiple specimens all at once. Applying this automated recipe method rather than manually and repeatedly doing the same calculations helps save time.

The Project Plan also has features useful for documentation and communication with collaborators. In the Specimen Prep subpanel, files can be attached such as specimen preparation instructions or notes. In the Report Templates subpanel, hyperlinks are displayed to allow easy access to report templates associated with the project.

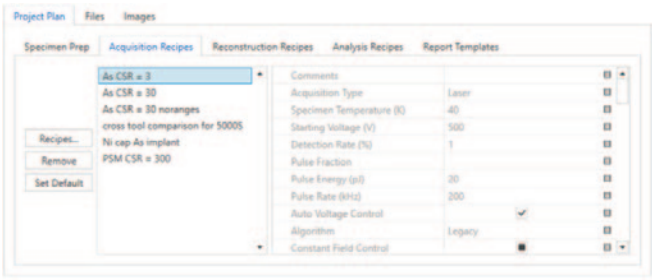
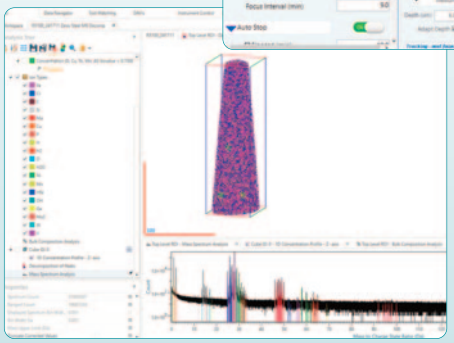


Figure 1: Project Plan is found on the Data Navigator module of AP Suite. Acquisition Recipes are used to pre-define the parameters in ACC.

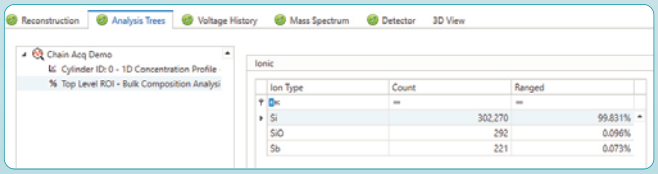
Acquisition Recipe





Reconstruction Recipe

Analysis Recipe



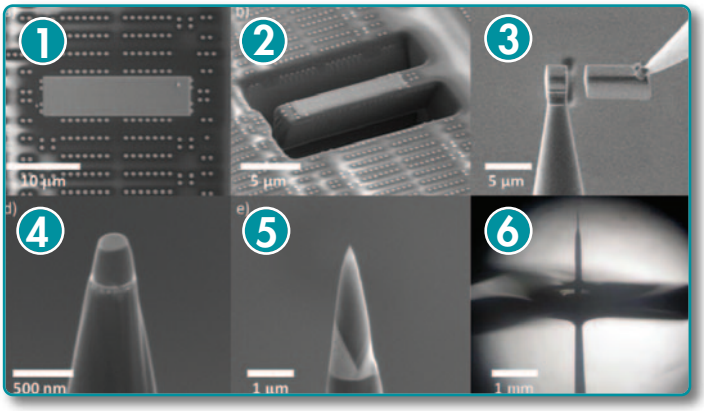
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CAMECA Atom Probe Technology Center: 5470 Nobel Drive • WI-53711 Madison • USA • cameca.leap@ametek.com • www.atomprobe.com

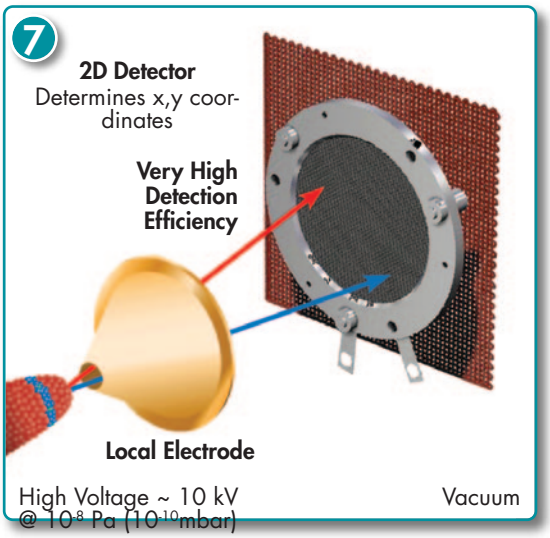
Three Steps to 3D Nanoscale Analysis

An Introduction to Atom Probe Tomography

Step 1: Specimen Preparation

An atom probe specimen usually has a nanoscale region of interest (ROI) requiring both 3D compositional imaging and analysis. The sample is formed into a needle shape containing the ROI. Common APT specimen preparation methods using electropolishing or a Focused Ion Beam system (FIB) are very similar to TEM methods except instead of forming a thin sheet, a needle shaped sample is desired. At the right, standard FIB liftout and mounting of a specimen (figures 1 through 3) and then sharpening the sample with the ROI left at the very apex (4 and 5). In 6, a wire geometry sample is being electropolished.





Step 2: Data Collection

An atom probe produces images by field evaporating atoms from a needle-shaped specimen and projecting the resultant ions onto a detector 7.

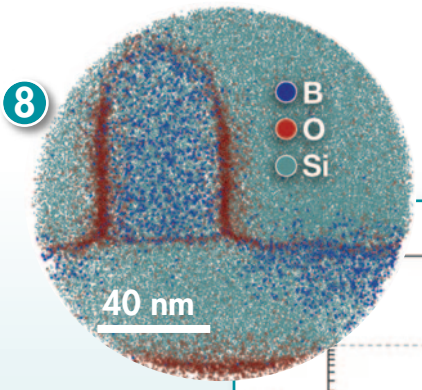
A high magnification results from the ~ 80nm tip being projected onto an 80mm detector resulting in a magnification of approximately 10^6.

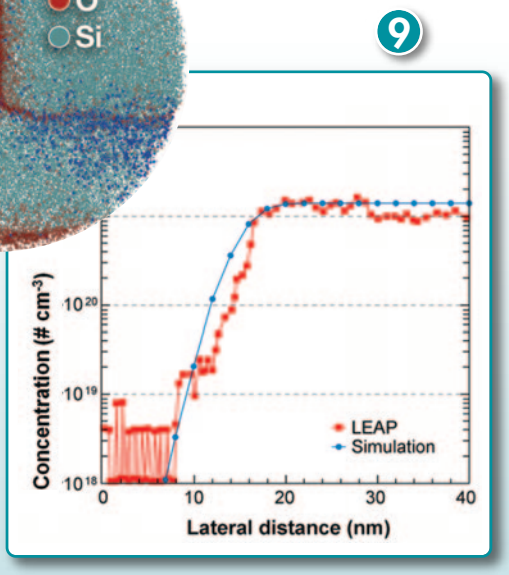
An atom probe identifies atoms by their mass-to-charge-state ratio (m/n) using time-of-flight mass spectrometry. Charge state, n, is typically 1 to 3.

The specimen is held at approximately 50K to reduce surface diffusion during the experiment. The high electric field results in 100% ionization and the high speed detector is capable of measuring up to 80% of the collected ions, independent of ion mass.

Step 3: Data Visualization and Analysis

Examples of data output are illustrated by a slice of a 3D atom map of a transistor† 8, and a dopant composition profile‡ 9. The image shows the positions of individual atoms (oxygen is red and boron is blue) in the transistor with subnanometer resolution. From the reconstructed data set many types of useful analyses are possible. These include 3D visualization, 2D atom mapping 8, 1D depth profiling and line scanning 9, as well as mass spectra and compositional analysis from user-selected volumes.





† Lauhon, L. J. et al, MRS Bulletin "Atom Probe Tomography of Semiconductor Materials and Device Structures" 34(10) (2009) 738.

‡ Moore, J. S.; Jones, K. S.; Kennel, H.; Corcoran, S., Ultramicroscopy "3-D Analysis of Semiconductor Dopant Distributions in a Patterned Structure using LEAP" (2008), 108, 536–539.

Ref. #APT-FF03 - Reprint 2024