Novel Ion Optics Design Ensures High Sensitivity And Mass Resolution For 3D Atom Probe

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The combination of the high mass-resolution reflectron lens and a patented, three pair delay line detector brings exceptional sensitivity to the 3-Dimensional Atom Probe (3DAP) from Oxford nanoScience Ltd. This unique combination brings the best atom probe mass resolution available commercially both at the conventionally quoted Full Width at Tenth Maximum (FWTM) and the much more challenging Full Width Thousandth Maximum (FW0.1%M). This makes the instrument particularly well suited to the detection of small quantities of dopant materials. In addition, unlike other commercially available detectors, up to 98.5% of the detected atoms are both spatially located and chemically identified.

The large-acceptance-angle reflectron lens is an ion mirror which uses an electrostatic field to reflect ions towards detector. This configuration gives outstanding mass resolution and brings new standards to signal measurement for 3-Dimensional Atom Probe instruments.

Mass resolution figures (M/DM) of 350 can be achieved at the conventionally quoted FWTM. Good resolution figures at the much more demanding FW0.1%M are a much better indicator of extremely narrow peaks without trailing edges. The use of the reflectron lens allows resolution figures of around 100 to be quoted at FW0.1%M. Specifying resolution figures much closer to the spectral baseline indicates the ability to identify small peaks adjacent to major peaks that are several

orders of magnitude higher.

The extremely narrow peaks produced and high signal-to-noise ratio allow accurate chemical analysis of complex alloys, where elemental peaks may be closely spaced in the mass spectrum and where some elements may only be present at low percentage levels.

Chemical identification and spatial location of a high proportion of detected atoms is of critical importance in determining the precision of measurements of low dopant concentrations where the detection of high levels of atoms are essential to guarantee low standard deviations on the measurements. In addition, overall sensitivity is a function of both the mass resolution and number of atoms counted.

The patented delay line detector features three pairs of low resistance wires wound around a hexagonal support. The three sets of delay lines allow discrimination of multiple ions arriving at the same time at the detector.