Spring 2016 News

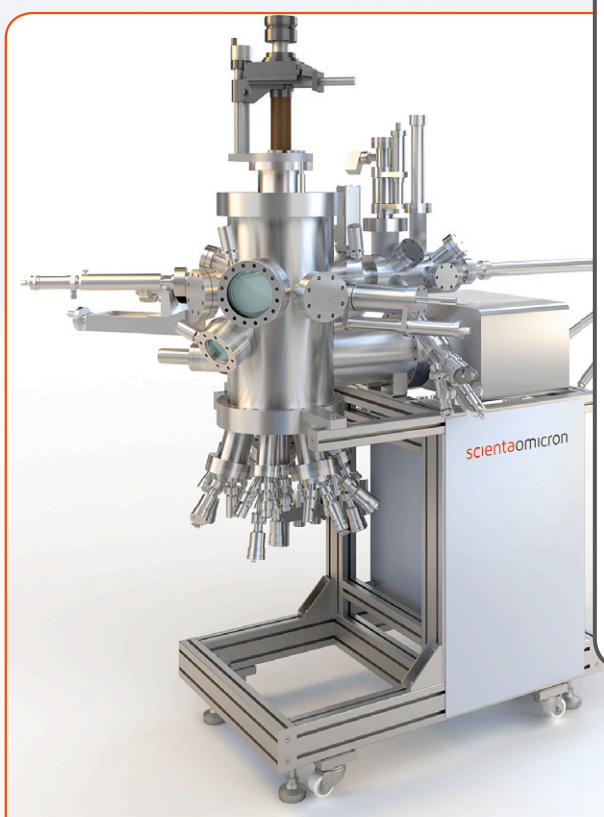
Scienta Omicron - Superior Technology

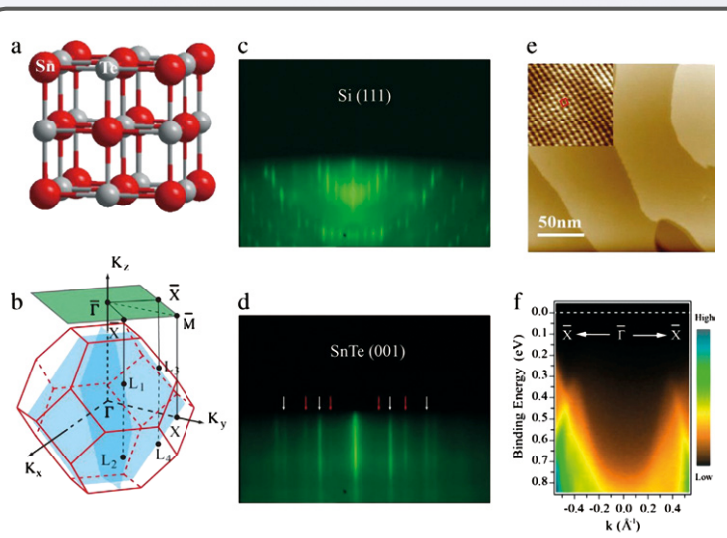
Lab10 MBE - MBE solution for surface science

The Lab10 MBE system is a turnkey research tool for innovative material development on small samples (10 x 10 mm sample size).
It is designed to fulfill the highest and most stringent requirements of modern thin-film deposition. It is a flexible system platform suitable for a wide range of MBE application including the deposition of metals, growth of semiconductors, magnetic materials, oxide layers or growth organic molecules. The Lab10 MBE also supports advanced preparation tasks.
The Lab10 MBE includes evaporation control software and offers multiple ports for sample characterization. Additionally it can be easily interfaced with other system modules.

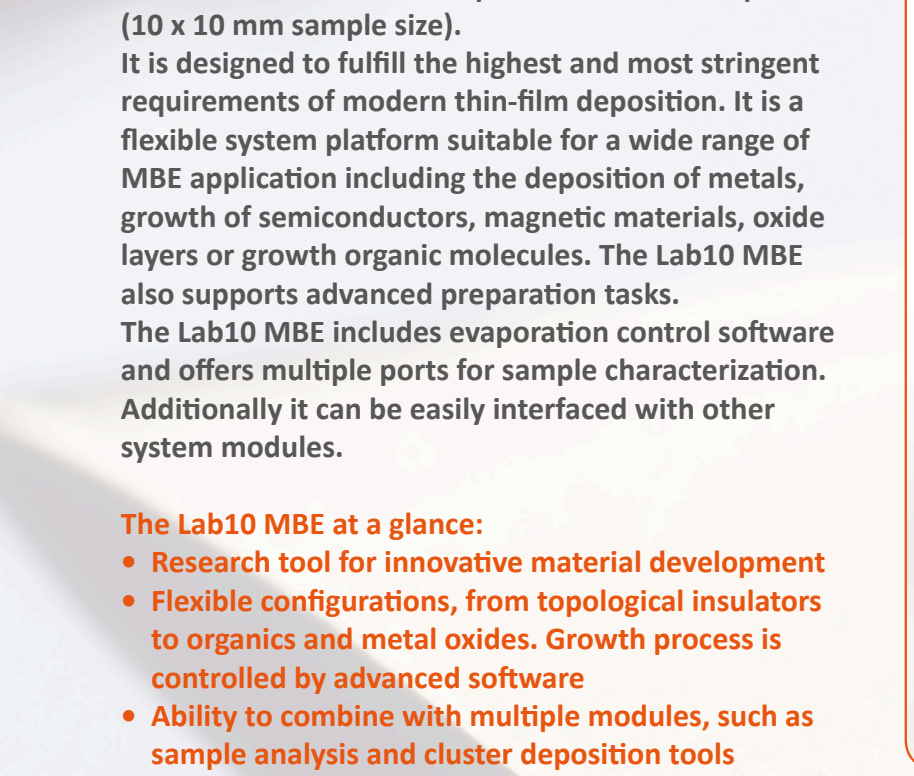
The Lab10 MBE at a glance:

- **Research tool for innovative material development**
- **Flexible configurations, from topological insulators to organics and metal oxides. Growth process is controlled by advanced software**
- **Ability to combine with multiple modules, such as sample analysis and cluster deposition tools**





MBE growth of SnTe thin films. (a) The crystal structure (b) The Brillouinzone. (c) The RHEED pattern of Si(111)-7 × 7 reconstruction. (d) The RHEED pattern of SnTe(001) film. (e) STM image of the SnTe film (200 nm × 200 nm). (f) ARPES spectra of the filmtaken along the Γ–X direction near Γ point.
Data courtesy :
Qi-Kun Xue et al. State Key Laboratory of Low-Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, China



HAXPES-Lab - A window to the bulk

The unique HAXPES-Lab is breaking the limits of conventional XPS by making use of the extended inelastic mean free path and therefore greater information depth of high kinetic energy electrons in matter. The new instrument allows for true bulk property analysis and surface characterization on real world samples without the need of surface preparation.

The core technology of the HAXPES-Lab utilizes Scienta Omicron's well proven EW4000 10 keV analyzer together with a novel 9.25 keV monochromatized X-ray source using a liquid metal anode. The Metal Jet technology allows generation of a small X-ray spot with unsurpassed power.
The electron analyzer features a market leading acceptance angle and detection system. This combination is ideal for efficient measurements in an optimized system design for ultimate HAXPES performance. The modular concept allows for combining traditional Al Ka XPS with HAXPES, in one system. Other modules for thin film deposition, e.g. MBE, can also be added.

The HAXPES-Lab at a glance:

- **Hard X-Ray at 9.25 keV available for a lab**
- **Superior analyser performance in HAXPES**
- **Complete lab solution**

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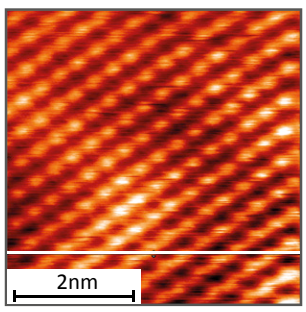
Closed Cycle SPM -
Recent STM & QPlus* AFM results from our R&D departement

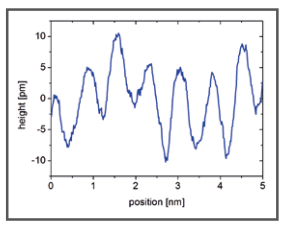
Scanning probe microscopes - which are aiming for an atomically precise resolution - are typically using flow or bath cryostats with liquid helium as the cryogen. Such experiments are rather expensive for research groups having no access to helium liquefiers, due to the permanent need and increasing price of liquid helium over the last years. An alternative approach to overcome these issues is to replace these conventional cryostats by closed cycle coolers. Here we present first STM and QPlus* NC-AFM results of a new cryogen-free cooled ultra-high vacuum compatible scanning probe microscope (SPM).

This Closed Cycle SPM is capable of high stability STM and QPlus NC-AFM operation at sample temperatures down to T = 9K. Overcoming the limits of hold time of cryogenic liquids this microscope provides access to new classes of experiments. Decoupling the strong mechanical vibrations induced by the closed cycle cooler represents a major technical challenge. Our design of the Closed Cycle SPM effectively decouples the inherent mechanical vibrations to a level of state-of-the art low temperature SPMs utilizing cryogenic liquids. The results clearly demonstrate the stability of the microscope and its capability of atomic resolution imaging and spectroscopy at low temperatures in the QPlus NC-AFM mode.

QPlus AFM on
NaCl (100) at T = 10 K



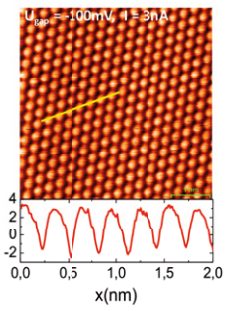
Atomic resolution QPlus AFM image



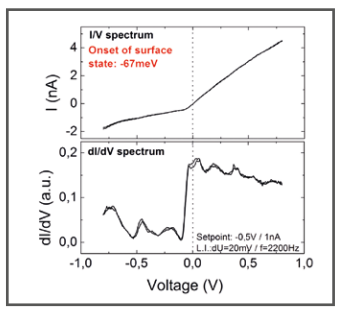
Profile along the white line


QPlus sensor

Ag (111)
at T = 9 K



STM measurements on Ag(111)
at T = 9K with running cooler



Proven high resolution scanning
tunneling spectroscopy on Ag (111)

Features of a Closed Cycle SPM:
- Interruption free experiments at low temperatures are possible
- No consumption of liquid helium
- Stabilized base temperature: T = 9K

* Franz J. Giessibl, Appl. Phys. Lett. 73, 3956 (1998)
Franz J. Giessibl, Appl. Phys. Lett. 76, 1470 (1998)

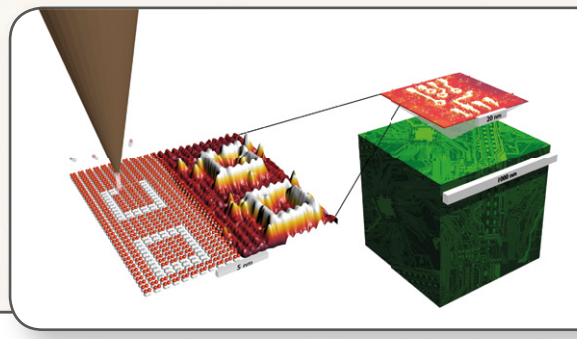
Scanned Probe Lithography
Scienta Omicron & Zyvex Labs announce collaboration

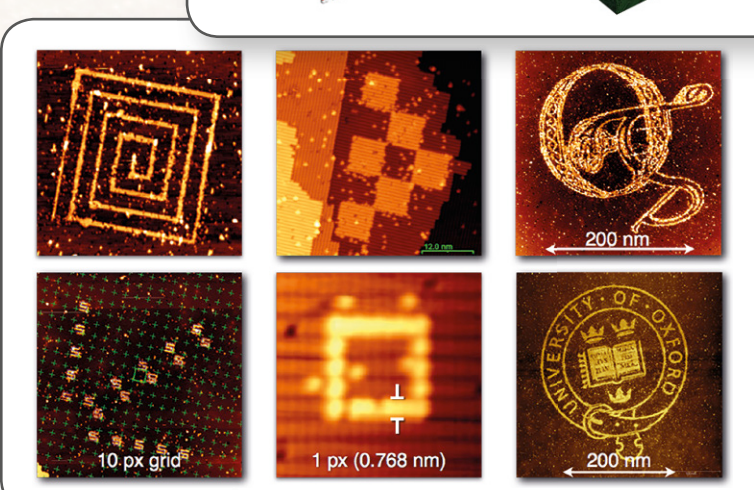
Scienta Omicron and Zyvex Labs announce a collaboration to develop and distribute tools for research and manufacturing that require atomic precision.
The ZyVector STM Control System from Zyvex Labs turns a Scienta Omicron STM into an atomically-precise scanned-probe lithography tool, and will be distributed world-wide by ScientaOmicron.

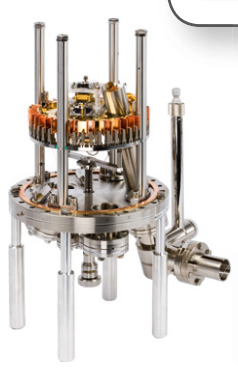
Scienta Omicron brings together the two leading innovators in Surface Science – the former VG Scienta and Omicron NanoTechnology. This exciting new company creates new capabilities for the research community by combining the technology leaders in electron spectroscopy, scanning probe microscopy and thin film deposition. These capabilities are available in custom tailored systems from one source with sales and service groups located in all major markets around the world.

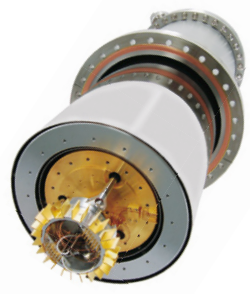
Zyvex LLC pursues the vision to develop Atomically Precise Manufacturing (APM). Recently, Zyvex Labs has developed ZyVector for automated STM Lithography to enable users to create quantum computers and other transformational systems that require atomic precision. By pairing it with Scienta Omicron STMs, unmatched lithography will be possible, with much higher reproducibility and throughput, scaling up from research level patterning towards APM.
See more at www.zyvexlabs.com

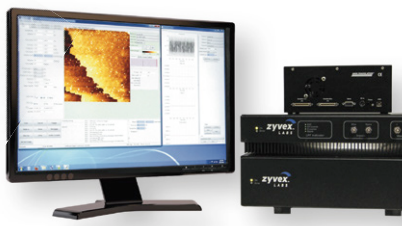
Capabilities
ZyVector automates the process of performing Hydrogen Depassivation Lithography (HDL), using an STM tip to remove H atoms from a surface. It can write arbitrary patterns defined in a vector or a bitmap format. Patterns can be written using a lithography pixel defined by the atomic lattice. As well as developing ZyVector as a tool for atomically precise patterning on small scale, researchers at Zyvex Labs are leveraging its capabilities to create nano-functional devices on the micrometer scale. ZyVector therefore opens up new possibilities to scale up SPM based lithography by setting new standards in reproducibility, automation, thermal drift and piezo creep compensation.






Scienta Omicron VT STM


Scienta Omicron LT STM


ZyVector STM Control System for
atomically precise lithography