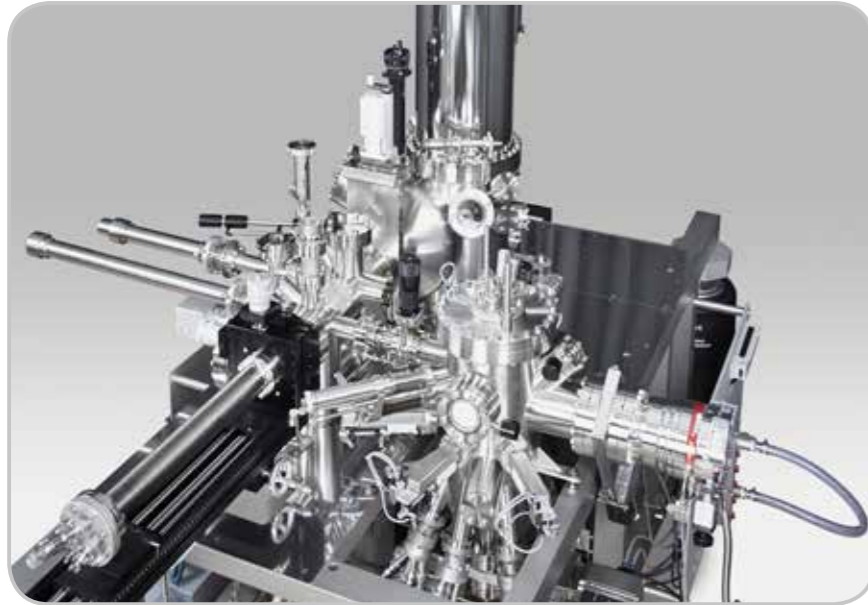


# LT-STM/AFM with MiniMBE System

The combination of two major components of CreaTec's product range

In order to minimize internal vibrations, the size of the UHV system has been reduced to a minimum. Instead of having separate chambers for preparation and analysis, CreaTec's system has only one chamber with an integrated gate valve. This also minimizes the length of the He cooled manipulator, which can be used to prepare, analyze and transfer the samples and the tips ( $T < 15$  K). The preparation chamber can be equipped with a variety of customer specific preparation and analysis tools.



STM Chamber



MiniMBE Chamber

## Main Features | LT-STM/AFM + MiniMBE

- Combined MBE growth and LT-STM/AFM
- High quality surface preparation
- Fast and reliable transfer
- Optimized for high resolution, state-of-the-art LT-STM and AFM measurements
- Base temperature below 5 K
- Lowest LN2 and LHe consumption
- Long-term low-temperature spectroscopy and atom manipulation
- Powerful software package included

## Electronics

CreaTec STM electronics\* are based on a digital design. A DSP (digital signal processor) controls the scanning parallel (x, y) to the surface as well as the tip/sample separation. All scanning/feedback parameters are fully controlled through the STM program. An additional high voltage amplifier and a current preamplifier complement the electronics. There are options to read data from external devices, too. Using the powerful scripting options of Phyton / Matlab etc., the user may write unique control algorithms beyond the already implemented features.

\* Other electronic solutions on request.



CreaTec High-Voltage Amplifier



# LT-STM/AFM

High-end atomic imaging, spectroscopy and manipulation

Design & Print: www.designprint-krasno.de



LT-STM/AFM



# Imaging, spectroscopy and manipulation

The combined low-temperature scanning tunneling and atomic force microscope (LT-STM/AFM) is an essential part of CreaTec's product range. In addition to its nanoanalytical capabilities, it allows the precise manipulation of atoms and molecules at temperatures in the range of 4 to 300 K.

## Main features

- Combined MBE growth and LT-STM/AFM analysis
- Compact multi-chamber design
- High quality surface preparation and fast reliable transfer
- Optimized for highest resolution, state-of-the-art LT-STM and AFM measurements without cross-talk
- Base temperature LT-STM/AFM < 5 K
- Lowest LN2 and LHe consumption
- Designed for long-term low-temperature spectroscopy and atom manipulation
- Lowest drift, highest stability
- Best cost performance ratio
- Short support time

## Multiple options

- Magnetic field
- Optical access allowing laser excitation and photoluminescence experiments
- High frequency cabling
- 1 K bath cryostat

## Powerfull software package

- Large number of high resolution A/D and D/A channels (10)
- Fully open OLE/COM interface and document file format
- Internal lock-in amplifier included as a standard
- Special spectra on grid module included as standard

## AFM

The fully compatible low-temperature atomic force microscope (AFM) allows simultaneous measurements of force and tunneling current without cross-talk using constant frequency or constant height control.

## Development

CreaTec has continuously developed this instrument to three different scanning probe systems: a **4 K LT-STM**, a combined **4 K LT-STM/AFM**, and a **1 K LT-STM** system. The 4 K microscopes are available as beetle-type scanner and PAN-type slider, with different options like e.g. magnetic field, optical access and high-frequency cabling.

# General Specifications

The data table beside presents standard values for a LT-STM/AFM System. Other specifications are available on request. Due to its compact design, it is possible to integrate different upgradeable options, such as Mini MBE, LEED, X-ray, evaporators, optics, etc. CreaTec experienced physicists perform the installation and provide an user training.

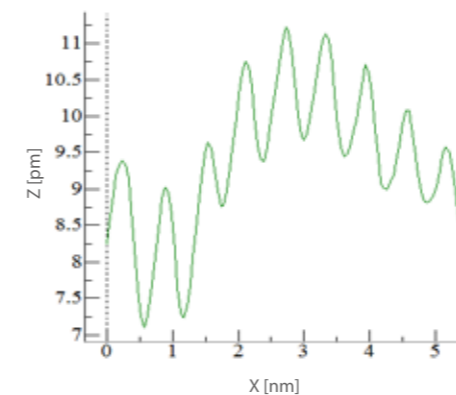
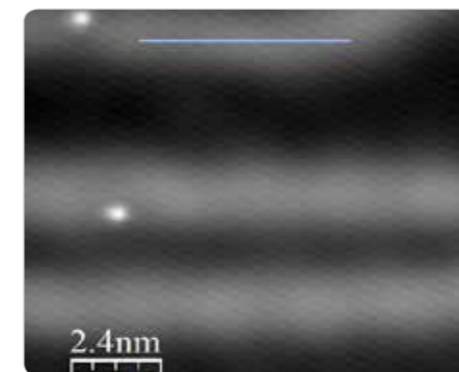


Scanner Head

TYPE	LT-STM/AFM	
SCAN RANGE	1.2 μm x 1.2 μm x 0.4 μm @ 5 K	
MIN. TUNNELING CURRENT	< 500 fA	< 200 fA achieved
AFM OSCILLATION AMPLITUDES	50 μm	10 μm achieved
STABILITY AT BASE TEMPERATURE	XY: <0.2 nm/h	<0.02nm/h achieved
	Z: <0.1 nm/h guaranteed	<0.01nm/h achieved
TEMPERATURE VARIABLE	5-300 K	lower temperatures optional
SAMPLE TRANSFER	at temperatures > 15 K	
HOLD TIME FOR LHe	(4 liters) up to 100 h achieved	up to 200 h on request
HOLD TIME FOR LN2	(14 liters) up to 100 h achieved	
NOISE LEVEL	< 1 pm achieved	
EL. CONTACTS TO THE SAMPLE IN THE STM	up to 7	
MAGNETIC FIELD	up to 2T	

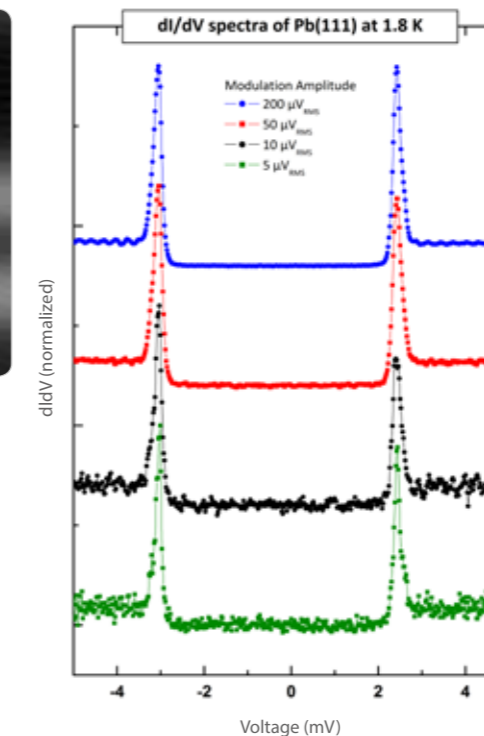
## STM - Results

Line profile showing atomic resolution on Au(111). The overall height is ca. 2 pm.



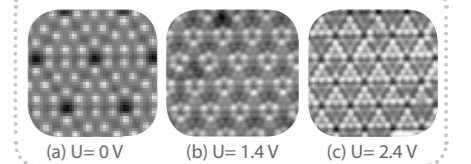
## STS - Results

dI/dV spectra of the same sample at different modulation amplitudes in the range of 5-200 μV (bottom to top).



## AFM - Results

### NC-AFM on Si(111)



### NC-AFM on Au(111)

