

Ref. No PH/PSA/134/2017-18

4th May 2017

Dear Sir/Madam,

Kindly send your best quotation for the **UHV Variable Temperature Cryo free closed loop Scanning Tunneling Spectroscopy System** with the following specifications on C.I.P. Bangalore basis. Your quotation should clearly indicate the terms of delivery, delivery schedule, E.D., payment terms etc. The tender should be submitted in two separate sealed envelopes - one containing the technical bid and the other containing the commercial bid, both of which should reach us, duly signed on or before 26th May 2017 to

**The Chairman
Department of Physics,
Indian Institute of Science, Bangalore 560012**

Please enclose a compliance statement along with the technical bid.

thanking you

Prof. P.S. Anil Kumar
Dept. of Physics
Indian Institute of Science

Specification

UHV Variable Temperature Cryo free closed loop Scanning Tunneling Spectroscopy System:

This should have minimum following Specifications.

STS system:

1. Temperature Range: below 10K to 300K preferably upto 400K. It should be variable temperature cryo free system.
2. Tip and sample should be independent heatable. Preferably the difference in temperature between sample and the tip while operation should be as minimum as possible.
3. System must be cooled via a closed-cycle cryostat. Must use a flag-style sample plate
4. Microscope chamber must be able to store up to a total of 8 tips and sample plates.
5. Must achieve atomic resolution in STM on Ag(111)
6. Suitable Vibrational isolation and damping should be provided.
7. Must offer radiation shields for optimal cooling performance.
8. A separate frame for supporting the closed-cycle cryostat must be provided.
9. Temperature stability has to be better than 1mK

10. Microscope chamber must offer a permanent optical path for monitoring sample approach and feature targeting.
11. System must be equipped with a multi-sample entry option for the loadlock chamber.
12. System must have XYZ drift as low as 0.2Å/hour
13. Overall system noise must be less than 2 pm
14. System must have available sample plates with 4 electrical contacts (optional)
15. A flange on the UHV chamber must be capable of supporting an ion sputter gun.
16. Should have Thermal Radiation Shields with Shutters

Scan Head:

Scan range: better than 2 μm X 2 μm X 0.8 μm at RT, 0.8 μm X 0.8 μm X 0.3 μm at 10K, Sample size up to 10 mm X 10 mm. Include Four (4) electrical contacts to the sample stage and Silicon diode and heater to the sample stage for temperature control.

Sample and Probe Exchange Holders:

- Adequate STM tip holders, sample plates, tip transfer plates etc should be provided for three years of operation

Closed Cycle Cryo Cooler:

1. Ultralow vibrations, UHV (10^{-11} Torr),
2. Service intervals of cryo cooler must be specified

Suitable Compressor to be included.

SPM Vacuum Chamber Assembly: separate UHV chamber for SPM to ensure minimum radiative heat introduction and optimal UHV conditions, independent of sample and tip preparation. Ports for sample transfer (wobblestick), separate pumping and at least 3 viewports.

Include suitable Wobble Stick, Viewports, Blanks, Hardware, and Gaskets

Quote optionally for a Dedicated sample preparation and analysis chamber separately: for preparation and pre-characterization of samples, including sample manipulator with heating stage (radiative and direct current heating, max. 900°C, optional upgrade to e-beam heating) and ports for sputter gun, LEED, at least two deposition sources, hemispherical energy analyser, dual anode X-ray source, UV source, electron gun for Auger electron spectroscopy, pumps, pressure measurement, and several viewports. Base pressure $<1 \times 10^{-10}$ mbar. Including ion getter, Titanium sublimation and turbomolecular pump with pneumatic gate valve and backing pump. Ion gauge for pressure measurement.

SPM Chamber Pumping: guaranteed base pressure in the SPM chamber $<1 \times 10^{-10}$ mbar, suitable Ion Pump with TSP and built-in bake out heaters, Ion Pump Control, Remote TSP controller and 3 meter cable. Vacuum Gauge Controller: Measurement range from atmosphere to 10-11 mbar. UHV Gauge.

Load Lock Pumping: TMP with minimum 67l/s with turbo power control unit, Pressure measurements and control, Turbo Pump Cable, Splinter Screen for Turbo Pump. Connecting

plumbing and hardware. Pneumatic Gate Valve. Wide Range Gauge and Convection Gauge (Foreline). Should include Up-to-Air Valve, Mini dry nitrogen vent and Solenoid Activated Purge-Vent Valve

Ion Sputtering Gun: Sputtering gun with direct gas inlet, Beam energy 0.3-3.0 keV, Spare filament set, Digital controller, Voltage range 0.12-5 kV, Front panel or computer control via built-in USB interface. Front panel timer and Precision gas leak valve

Bakeout Hardware: Easy-to-install Bakeout Insulated tent, Wobble stick jacket and Transfer arm jacket. Bakeout Heater Control with Thermocouple controlled power distribution to bakeout heaters, Individual breakers for each circuit, Bakeout timer, Interlocks with TSC, Over-temperature safety shutdown, Integral with emergency stop system. Bakeout Heater Fan with Thermostatic Control

Suitable Instrumentation Rack

Include suitable Temperature Controller, Heating Power Supply & Temperature Controller, Power Outlet Strip for Control Rack and Blanks with Mounting Rails for Expansion

UHV CONTROL SYSTEM: appropriate user friendly control system

SPM CONTROL SYSTEM:

Complete SPM/STS control system with adequate number of DACs and ADCs with optimum resolution and bandwidth to acquire atomic resolution images and high quality scanning tunneling spectroscopy data. Low noise, resolution, acquisition speed and bandwidth will be a crucial qualification criterion. An expert committee will scrutinize the proposed solution and preference will be given to optimum solution. The system will be extensively used for generating STS at 10K for topological insulators, transition metal dichalcogenides, superconductors etc.

Scan Generator:

- Digital scan generation
- Image rotation
- Hardware supported zoom
- data acquisition rate: ~ 200 kSamples simultaneously with up to ~ 4 channels or an appropriate solution

Piezo driver:

Appropriate driver

Coarse positioning:

16-channels, variable step size and frequency, remote control, software control and auto-approach

Signal access:

Through front panel mounted BNC connectors.

Configuration should include:

Control System, Software, Data Management Tool, data processing software, PC /i5/8GB/SSD/HD/ two-Network-Cards; Windows 7 or 10 Pro 64bit , 1 x 26" or 2X23" LCD monitor

Usability

Scan control via control windows or within data displays, configurable numerical value control (parameters, limits, forbidden values), data favourites gallery and data rating, copy & paste functions for images and data, copy to scan clipboard as navigation aid, data comment system, prophylactic data storing support, tip movement visualisation

Scan Control

Scan modes (image, line, point), up-down scans, scan modes (constant line frequency or constant scan speed), separate settings for scan speed & tip move speed, line delay function, zoom, pan & rotation, automatic drift correction using FFT analysis.

Tip Preparation

Voltage pulse, tip indentation, combination of both or a suitable solution

Regulator

True 20-bit z-resolution over full z-scanner range, z-imaging with dynamic resolution of > 24 bit, two independent branches for regulation & measurement signal if needed, selectable regulator characteristics (logarithmic or linear), support for using unspecific signals as feedback loop input, dual mode imaging (different parameters for forward & backward scan), slope correction, z-profiling & dual pass technique, auto approach settings for approach mode, speed, delay times & slew rates, gain switches, switchable low pass filters for distance regulation & external gap voltage, z-meter for tip control

Spectroscopy

Single point & grid, voltage & z-ramps, varied z-spectroscopy, dual mode spectroscopy, multiple curves, reversal ramp, modulation switches, trigger signals to synchronize third party equipment.

Flexible Experiment Control

automation, experiment modifications during a running experiment, trigger signals for experiment states (i.e. position reached, scan finished, line finished, etc.)

Remote Interface

Remote access (control by external software packages, i.e. LabVIEW)

Data Management

Browsing, filtering, sorting, data export (JPG, TIFF, BMP, ASCII, IGOR Pro, Flat File Format (FFF)), Application Programming Interface (API)

Necessary Accessories: Include Scanner Flange Support Stand, Controller Accessories (like Tunneling Gap Simulator for preamp and feedback diagnostics, Straight-through and crossover ethernet cables, BNC-to-BNC cables for back panel connections), Scanner Tool KitSystem, Tool

Kit (include wrench set, gaskets etc), Closed Cycle Cryostat Tool Kit and CCD/USB Camera with software, Twisted pair and coaxial cables, low noise feedthroughs and connectors, Light source to observe tip/sample positioning, Monitor

Sample plates: e.g

- Stainless steel sample plates (5x)
- Molybdenum sample plate for direct current heating for sample preparation (1x)
- Tantalum sample plate (1x)
- Pre-mounted samples: HOPG (1x), Au film on Si (1x), Au on Mica (1x)

Optionally quote following:

1. suitable water chiller.

Acceptance criteria document should be included.

A compliance statement should be included

Details of warranty and the cost for AMC

Details of installation and training plan should be included.

END