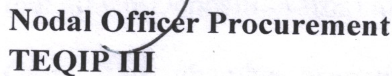
Office of the Coordinator TEQIP III
National Institute of Technology Srinagar

NO. : NIT/TEQIP19/221
Dated: 02-03-2019

Corrigendum

With reference to the **"Invitation for bids for Multi Target Sputtering System" IBF No. TEQIP-III/nits/189** dated **26-11-2018**; the specifications have been revised due to concern raised by the various suppliers.
The Revised Specifications can be found at **Annexure I**. Moreover the last date for the submission will be same as issued earlier.



Nodal Officer Procurement
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Annexure I

TECHNICAL SPECIFICATIONS

Main features of sputtering system:

- 2" dia Sputter source for con–focal deposition.
- Rotatable 3" substrate holders with substrate heater from Room Temperature to 800 ^{o}C with substrate bias.
- Chamber pressure in 5 X e-7 mbar range or better with fast pump down times.
- Three -2" Diameter sputter guns with shutters capable of holding 2-inch Diameter Targets with both head angle and height adjustment facility
- Capable of achieving uniformity +/- 3% across 3" substrate for metal, oxides,nitrides &thin films
- PC or HMI based automated control at customer's option.

Description of sputtering system:

The sputtering system (100 Class clean room compatible) will be used for deposition of high quality, uniform metals and gate dielectric oxide ultrathin films. Turbo pump backed main chamber with vacuum in low 10^{-7} mbar range (higher preferable) and turbo-pumped load lock chamber for fast pump down times. Three shuttered magnetron guns with two-inch diameter targets. It should be possible, dependent upon source configuration, to deposit magnetic and non-magnetic metals and insulators via both DC and/or RF power. Co-deposition module should allow for DC/DC or RF/DC or DC/DC/RF or DC/RF/RF sputtering simultaneously. Please note that all Co-Deposition from all 3 Magnetrons should also be possible in the above configuration.

Gases flow, chamber pressure, and substrate holder with motorized Z-motion of substrate for dynamic working distance control via the process control system for optimizing deposition conditions. Heated substrate holder that maintains temperature control from Room Temperature to 800 ^{o}C before, during and/or after deposition. Substrate holder can be rotated and accommodates substrates 3" diameter. The system must be capable of achieving uniformity +/- 3% across 3" substrate for metals, oxides, nitrides & thin films across 3" substrate.

Detailed Specifications for sputtering system:

i) The equipment should be able to deposit any combination of metals, metal alloys, composites, semiconductors, insulators on semiconductor/glass/metal/alloy substrates in a single run as per the number of sputter sources and power supplies detailed herein.

ii) **Main chamber:** Stainless steel construction, ≥ 2.5" view port with load lock capable of handling 3" substrates.

iii) **Ultimate Pressure:** 5 x 10^{-7} mbar range or better. Stable Process Pressure during process better than +/-0.1 mbar during entire process and over the sputtering pressure range of 1E-3mb to 9E-3mb.

iv) **Vacuum Chamber:** SS, Cube or D- shaped or suitable shape chamber (minimum chamber dimensions 400mm x 400mm x 400mm or more) with load lock chamber capable of handling 3" diameter substrates. The chamber should have 06 nos. of spare ports (to be discussed during manufacturing) including an NW40CF for RGA. One numbers of view port with shutter arrangement on the front door is required. The chamber acts as sputtering chamber. It houses magnetron cathodes, substrate and shutter assembly etc. All the ports are fixed with Viton O-ring seal/OFHC copper gaskets as the case may be and matching flanges for vacuum integrity. The equipment should have water cooling arrangement to the magnetron sources to ensure uniform cooling of the target during sputter deposition. The chamber configuration is for sputter up geometry with proper provision for substrate holding such that the deposition should not get shadowed.

v) **Sputter cathodes:** Three of, two-inch target diameter sputter sources with auto shutters and shielding to prevent cross contamination. The sputter sources should be compatible with magnetic materials in addition to conducting and non-conducting materials. Please note that 2 Magnetrons should be configured for Non-Magnetic materials while 1 magnetron should be configured for magnetic materials.

vi) **Load Lock chamber:** For loading and unloading of samples without breaking vacuum of process chamber. Separate vacuum pumping system required for load lock arrangement. Required capacity of Turbo molecular pump with suitable dry type backing/roughing pump. Please note that it should be possible to etch the substrate in the load lock chamber using an RF Plasma via an automated procedure which also checks for interlocking of RF power via a switch, gate valve in the closed position and vacuum levels in the load lock. All the necessary components to be able to RF etch the substrate before loading it for deposition should be included. Please note that the RF Plasma etch process should be fully automated & recipe driven. An automated selector switch to be provided to switch 1 RF power supply between sputter source and RF cleaning in load lock

vii) **Magnetron Source geometry:** The equipment should have three magnetron sputtering sources placed in a confocal configuration for multilayer deposition without breaking the vacuum as standard. Co-Deposition Capability should also be offered. The equipment should have provision to accommodate targets of 2" diameter. Changing of targets should be simple, quick and possible without breaking any internal seals. All the sources should be equipped with dedicated shutters. The quoted magnetron sources should be compatible with any of the DC, pulsed DC and RF power supply for con- focal deposition. A port for parallel configuration of sputter source should also be provided. (This port will be used to mount 1 of the 3 sputter sources so that target and substrate are parallel) Compatible user friendly software for con-focal and multi-layer deposition should be provided by the supplier with a provision for depositing multiple targets even when only one power supply is working. A manual change over switch should be provided with 1 input and 3 output so that even with one power supply multilayer deposition can be carried out. The

software should have provision to pause the deposition after 1 material is deposited so that user can manually change the power supply connection to second sputter source and continue deposition using software. The software should be developed in consultation with the end user.

viii) **Power Supplies:** Two RF power supplies of 300 Watt at frequency of 13.56 MHz with auto matching network (of reputed make, such as SEREN /Advanced Energy /Comdel /T&C power conversion for both the RF generator and RF Matchbox) should be provided. One 500W or more DC power source (reputed SEREN/ Advanced Energy/ Comdel /ADL/Glassman) make with automatic arc suppression (Documentation of Automatic Arc Suppression details from the original manufacturer should be included in the technical bid). A manual switch to run all the three magnetrons should be provided in case one or two power supplies goes bad.

ix) **Substrate fixture:** 3" Diameter Substrate holder with motorized Z–motion for working distance adjustment and substrate transfer.

x) **Substrate Rotation:** The equipment should have provision so that the substrate holder can provide in situ rotationwhile heating (0-30 rpm).

xi) **Substrate Heater:** The equipment should have provision for substrate heating from Room Temperature to 800 ^{o}C with PID control. The in vacuum heater parts used for substrate heating in item should be compatible with vacuum, plasma and a reactive environment.

xii) **Substrate shutter:** An automated shutter should be positioned in close proximity to the substrate platen in order for increased heater temperature ramps and to allow for deposition to crystal sensor head rate set up without coating of the substrate.

xiii) **Substrate Bias:** A Dedicated Separate DC Power Supply to provide a 0 to 500 V Substrate Bias to be provided. Please note that the DC Substrate bias will be used while deposition & will be controlled directly via software.

xiv) **Thickness uniformity:** ≤ ±3% across the 3" substrate

xv) **Vacuum pumping System:**Process chamber - High Vacuum pumping module should consist of a Turbo Molecular Pump of 350-400lit/sec or more, Dry scroll Pump 10m^3/Hr or more, vacuum measuring gauges with all the necessary valves to have a fully automated pumping system. The pump down sequence as well as venting sequence should be fully automated & controlled via the PC or HMI Process Control. The basic system must be capable of giving vacuum order of 5 x 10^{-7}mbar or better. Pump should be Pfeiffer/ Leybold /Edwards make.
Load lock - High Vacuum pumping module should consist of a Turbo Molecular Pump of 60 lit/sec or more, Dry scroll Pump 5m^3 /Hr or more, vacuum measuring gauges with all the necessary valves to have a fully automated pumping system. The pump down sequence as well as venting sequence should be fully automated &

controlled via the PC or HMI Process Control. The basic system must be capable of giving vacuum order of 5 x 10^{-7} mbar or better and a pump down time to 2E-6mb of less than 20 minutes. Pump should be Pfeiffer/ Leybold/Edwards make.
Required water chillier with connection will be part of vendor supply.

xvi) **Valves:** All necessary valves to be able to have a fully automated pumping system should be included. Also, the necessary throttle valve to be able to control process pressure will have to be provided.

xvii) **Gauge Heads:** All gauges should be of Edwards/ Leybold / Pfeiffer/Granville Philips make. Necessary gauges for measurement of vacuum to be included in the system. Please note a Temperature Controlled Capacitance manometer should be included for measurement of process pressure & control. The process pressure control should be fully automated capable of controlling process pressure with a stability of +/- 0.1 mbar. Please note that the process control should be fully automated.

xviii) **Gas Flow:** The equipment should comprise of three Mass Flow Controllers (of reputed make) with the option of a fourth, with power supply to control the flow of Argon, oxygen and nitrogen into the sputtering chamber. MFC lines should be leak tested to 1E-9mb. MFCs should deliver gas to the chamber via a manifold that allows for ratio mixing. Manifold should have a purge function to prevent memory effects run to run. Suitable gas channels (separate channel for each gas) are to be provided for argon, oxygen and nitrogen. MFC dynamic range to allow for process pressures from 1E-3mb to 1E-2mb and an O2 to Ar ratio of up to 1:30

xix) **Process Control**: PC based or automated, user friendly OS with recipe builder, data logging and report generation. The system should enable precise monitoring and control of film thickness and rate of deposition.
Appropriate fully automated pressure control should be offered as standard.

xx) **Supply of Sputtering Targets:**Cost should be mentioned with and without targets. Oxides & Nitrides: Al_2O_3, DLC, Er_2O_3, HfO_2, V_2O_5, VO_2, ZrO_2, TiO_2, Fe_2O_3, TiN, PZT, GNP. Metals: W, Fe, Cu, Ni, Ta, Al, Cr, Co, Graphene etc. Backing plate should quote wherever required

xxi) **Thickness controller:** Inficon make/ SQC 310C with three film thickness monitor sensors(water cooling)

xxii) **Utility:**
a. Electrical: Single Phase 220V /50Hz, 32 A, AC Power Supply
b. Suitable Water Chiller will be supplied by the vendor
c. Air: compressed air > 80 PSI.
d. Process gases, high purity, dry gas at 25 psi, 100sccm flow rate
e Vent gas – dry nitrogen at 5 psi

IMPORTANT INSTRUCTIONS& ESSENTIAL CONDITIONS:

- **I)** The vendor should provide a schematic diagram of the whole equipment clearly showing the configuration.
- **II)** The vendor should offer in case of successful bid, pre-delivery inspection of the equipment at their site for all thefunctionalities of the equipment as per the technical specifications mentioned in the tender document.
- **III)** A Compliance statement against each item mentioned in the technical specification must be provided in tabularformat.
- **IV)** Warranty: The complete instrument and accessories excluding consumables should be under warranty for a period oftwo year from the date of installation. In case of breakdown during the warranty period, a competent service should be provided
- **V)** The Bidder should have atleast 5 systems with similar capabilities installed world-wide. They should have atleast 1 customer in India with similar system specifications /capabilities. User Reference Details with Detailed address, telephone number as well as email address to be included in the bid.
- **VI)** Engineer of the supplier should make as many visits as are necessary to rectify the problem and replace the faultyparts. But it should be repaired within reasonable time from the date and time of complaint lodged by the user. Thesupplier should provide all spares required for making the instrument operational.
- **VII)** AMC: Please also mention the financial involvement for three years on site Annual Maintenance after normalwarranty period separately as an additional offer.
- **VIII)** Training and demonstration: Vendor should provide on-site demonstration of all the features of the system and training to operate the system should be arranged at no extra cost.
- **IX)** Operating manual: One set of operating manual, service manual, maintenance and safety instructions, recommended recurring spare parts list, mechanical and electrical drawings, part lists, air, water and electrical diagrams (inEnglish) should be provided with the instrument.