ANNEXURE-V

Chemical Mechanical Polishing (CMP) System

Sl. No.	Specification: Parameter	Specification Value
1	Machine type	1) Fully automatic benchtop system suitable for use inside a clean room environment with a GUI (Graphical user interface) on a touchscreen display. 2) The CMP machine should Controlled by embedded PC with LCD touch screen, flexible graphic user interface to control and change all the necessary operating parameters (slurry flow rate, rotation speed of platen table/polishing head/conditioning head and up & down movement, pneumatic pressure on the sample, download pressure etc.) of the machine. It should have provision of running different programmable recipes. ability to automate an entire CMP process consisting of various sub-processes. 3) The machine should also have functionality for real time data collection and feedback and allow user to export information for external analysis. 4) Machine should have a full manual control to allow in-process adjustment of parameters as well as machine should have fully automatic control system.
2	Maximum Substrate size	Machine should have capability to process part wafers (smaller sizes) and full wafers up to 2 X 4”/100 mm.
3	Total Thickness Variation	TTV after polishing shall be ≤ 4 micron across 4" wafer (≤ 1 micron per inch)
4	Final Surface roughness after polishing	Capability to achieve (Ra) surface roughness better than 1 nm as per AFM/DEKTAK measurements.
5	In-situ Sensors	in-situ sensors should constantly provide the operator with real-time process information of plate, slurry and waste slurry temperature to identify and evaluate important process conditions such as End Point Detection (EPD) or process stability factors which are paramount for optimal performance.

6	End Point Detection	Machine should have the End Point Detection function to identify changes in the data feedback from the integrated machine sensors and PLC's during wafer processing. User should be able to apply the Control limits to specific sensor parameters e. g. COF (Co-efficient of Friction) and It should be used for the End point detection. If the control limits are exceeded during the processing, then machine should automatically end the process or move to a flush cycle before ending the process cycle.
7	Substrate/Wafer Carriers	Machine Should have at least 2 substrate carrier to process the sample sizes of up to 4" on single plate. Both can have capability to use it for pad conditioning head during, after and before polishing process.
8	Substrate/Wafer Carriers Control	It should have independent speed control for both the substrate carrier heads in the range of 10-100 RPM with minimum increments of 1 rpm. The wafer carrier arm should have sweeping movement to increase the process uniformity and to use the whole surface of the polishing pad.
9	Carrier download pressure and	Machine should have the ability to apply download pressure through air pressure between 0.4 psi to 9 psi with minimum pressure Increments by 0.1psi. both the carrier pressure should be controllable through the GUI (Graphical user interface).
10	Wafer back pressure	Substrate carrier should have the ability to apply uniform pressure to the samples using Pneumatic in the range of 0 – 50 psi with minimum pressure Increments by 0.1psi.
11	Polishing Platen/Pad	Suitable size (400 mm diameter or more) platen for polishing wafers up to 4"dia shall be provided.
12	Platen speed and direction	It should have independent speed control in the range of 10-100 RPM with minimum speed increments of 1 rpm and it should have the ability to rotate in clockwise and CCW direction.

13	Polishing pad Conditioning Head	Pad Conditioning head & necessary conditioning tools shall be supplied with the machine to condition polish pads before, during and after CMP process. The conditioning tools either can be of diamond discs or Brush conditioner depending upon the pad type suitable for different wafer (hard and soft material) processing should be provided. The conditioning head should have provision of variable rotation on its axis (speed 10 rpm to 100 rpm) and it should have up and down movement as per the process requirements. The conditioning arm should have sweeping movement to increase the process uniformity and to use the whole surface of the pad.
14	Slurry Delivery	Minimum 2 Suitable peristaltic Pumps should be provided with the machine for Slurry/colloidal delivery with flow rate control through GUI, settable between 20-500 ml per minute or wider with minimum flow rate Increments by 1ml/min.
15	Interlock	All the doors should be preferably interlocked for better safety. System to be supplied with a fully enclosed hood and exhaust port as standard.
16	System control:	All process conditions should be controllable via the Graphical User Interface (GUI) Touchscreen, including: polishing plate speeds, plate direction, Slurry feed, carrier speed, Sweeping, wafer back pressure and carrier download pressure. Control system should have capability to create, save and recall process recipes. Control system should have facility to export the process information/polishing data via USB port for external analysis.
17	Machine construction	It should be Chemically resistant to standard chemicals used in CMP applications, including sodium hypochlorite (Na OCL). Machine should have integrated de-ionized water gun and nitrogen gun for sample/work area cleaning to avoid the cross contamination.

18	Installation and Acceptance Criteria:	Vendor shall install, commission the complete equipment at user location (IITM), demonstrate its capability and provide the training to IITM staff about silicon and oxide CMP process (2" & 4" diameter silicon wafers-wafers shall be provided by the user) by achieving final surface roughness <1 nm.
19	Training:	Complete Process Training and support to be given to IITM for the operation of CMP machine at IITM.
20	Necessary spares & Accessories	It shall be provided with system.
21	After sales support	Maintenance support, spares/consumables supply and unlimited maintenance support for equipment trouble-shooting to be ensured for 10 years after commissioning and acceptance including one-year warranty period.
22	Foot print inside cleanroom	Smaller than 985x1382x1123 mm (L x W x H)