INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

MATERIALS MANAGEMENT DIVISION

Powai, Mumbai 400076

Technical Specifications for the purchase of Lab Scale Plasma Enhanced Chemical Vapor Deposition System

Department of Electrical Engineering
IIT Bombay
Mumbai 400 076

Sl. No	Part Description	Parameter specifications
1	**Major application**	Typically for deposition of undoped and doped hydrogenated amorphous silicon thin films (undoped a-Si:H_X, (n)a-Si:H_X and (p)a-Si:H_X). The equipment should serve the purpose of depositing one material or stack of two or more.
2	**Wafer loading capacity**	Single wafer per deposition
3	**Wafer size**	Most of the processing would be done on 5 inch X 5 inch square wafers. But the system should be capable of processing 156.75 mm x 156.75 mm square/pseudo square wafers.
4	**Wafer thickness**	200 µm, typical
5	**Control over stoichiometry via process conditions**	Proper standard recipes for the films mentioned above.
6	**Load station**	Separate load lock with 1 process chamber. Load locked automatic wafer entry. Wafer should go into the chamber at the start of recipe and come out at the end of recipe.
7	**Gas box**	Atleast 12 - line gas box (mandatory) with 7 MFC's and remaining empty spaces for future upgrades
8	**Approx. Dimensions (load lock and process chamber)**	• Less than L X W X H = 6 feet x 3 feet x 7 feet. • Pumps and gas box dimensions may be additional.
9	**Layer thickness Uniformity**	< ± 5% over 5 inch x 5 inch area.
10	**Index of refraction**	a-Si:H_X : 3.2 - 4.5
11	**Refractive Index Uniformity**	< 1% (min. - max.)
12	**Deposition rate**	> 25 nm/min for a-Si PECVD
13	**Substrate temperature**	Upto 400°C with stability equal to or better than ± 5 °C

14	**Precursor gases (for thin film deposition)**	SiH4, PH3, B2H6, N2, H2, Ar, He
15	**Precursor gases for plasma clean**	CF4
16	**AC Power**	400 V line rms, 50 Hz, 3 Phase 5 lead
17	**Control system**	Computer controlled load lock and chamber operation, recipe creation including pressure setting, gas flow controls, substrate heating, process time
18	**Vacuum chamber**	The proposed PECVD system should be machined from single block of metal and should have the provision for view port and load lock.
19	**Electrode**	Electrode size should be sufficient to accommodate 157 mm x 157 mm square wafers. It should have embedded heater for heat substrate up to a minimum of 400 C.
20	**Load Lock pumping**	• Load lock should have separate dedicated dry pump. • Capacity should be at least 15 m3/hr dry pump, with hardware to integrate the pump to the loadlock, including flexible tubing. • As we are using thin wafers of 200 µm and hence the load lock should be equipped with soft pumping to avoid wafer sliding.
21	**Process pumping**	• Capacity should be at least 560 m^3/hr dry pump with roots. • It should feature N_2 purge facilities (such that the nitrogen purge should be allowed only during the plasma processing) with standby mode for low running cost. • Pump should be software remote controlled with status monitoring and water cooling for precise temperature management. • It must include hardware to integrate the pump to the system process chamber, with flexible tubing.
22	**Pressure Control**	Chamber should be equipped with automatic pressure control valve and heated capacitance manometer to be able to achieve desired process pressure during deposition.
23	**Gas Handling System**	• The gas handling system to accommodate 12 channels fitted with 8 channels of mass flow controllers. • 4 empty channels may be used for future upgrades. • MFC's should be calibrated for silane, phosphine,

		diborane, nitrogen, hydrogen, carbon tetrafluoride, argon and helium with suitable capacity to support a-Si:H deposition as per requirements stated above. • Toxic gas lines must have bypass line and metal seal MFC's only. All the lines should be fitted with one electro-pneumatic isolation valve and in-line 2µm filter.
24	**RF Power Supply**	• The RF power supply operating at 13.56 MHz frequency should have an output power of atleast 600 W. • An LF generator of 500 W, 100 kHz must be included for PECVD stress control. • Digital display of forward and reflected power, RF voltage, and matching network settings and other important operating parameters should be readable on a software in host computer.
25	**Host computer system**	• Must include control software which runs on MicroSoft Windows 10 or newer operating system. • The software should allow multiple levels of system control. • System status to be displayed on graphic mimic diagrams with all operational parameters and status displays should be accessible. • Recipe programming to be provided for all major process parameters. • Each gas line may be defined, with input of mass flow settings directly in sccm. • The software should include full data logging capability of user-selectable run-time process parameters, allowing off-line verification and analysis of process conditions. • Relevant Hardware should be supplied including keyboard, CD drive, mouse and all relevant cards.
26	**Spares**	One complete set of maintenance kit should be provided.

Demonstration for verification of technical specifications and uniformity

The Supplier shall at its own expense and at no cost to the Purchaser carry out deposition of 100 nm of undoped a-Si:H on a 200 mm diameter single side polished oxide coated silicon

wafer. The a-Si:H film should be deposited using the same base model of the tool that is quoted. The wafer should be suitably packed and delivered to IIT Bombay. The optical properties of the oxide should be provided by the supplier. IIT Bombay would measure the a-Si:H film for thickness and refractive index uniformity using methods like spectroscopic elliposmetry, SEM, ... as part of the technical evaluation.

- Commissioning of the tool and training of IIT Bombay designated personal at IIT Bombay should be included in the quote.
- Conduct and conclusion of the acceptance test for the installed goods and equipments shall also be the responsibility and at the cost of the Supplier.
- Supplier should supply operation and maintenance manuals in English together with drawings of the goods and equipments built. These shall be in such details as will enable the purchase to operate, maintain, adjust and repair all parts of the works as stated in the specifications.
- Warranty for at least one year should be included in the quote.