

## Specifications for Inductively-Coupled Plasma Deposition System.

1. The Naval Research Laboratory (NRL) has a requirement for an Inductively-Coupled Plasma (ICP), Plasma-Enhanced Chemical Vapor Deposition System capable of depositing silicon nitride films on to semiconductor materials.
  - a. The primary requirement is to deposit silicon nitride films using three gases (nitrogen, ammonia, 5% silane in a balance of nitrogen). The gas handling system must be capable of modification to deposit silicon dioxide films.
  - b. The chamber must accommodate an 8" wafer. The thickness uniformity must be better than  $\pm 5\%$  over a 6" diameter wafer with an index of refraction for deposited silicon nitride of  $2.00 \pm 0.05$  over a 6" wafer.
  - c. The system must be equipped with a vacuum load-lock to eliminate venting of the deposition chamber to atmosphere. The load lock pressure must be less than 100 mT during the evacuation cycle. The system must have an automatic shut-off of load-lock gate valve at a programmed pressure. The load lock must be equipped with the necessary mechanisms to load 2", 3", 4" wafers as well as mounts to handle quarters of 2" wafers and irregular pieces smaller than 2" in diameter.
  - d. The system must include a computer-based system controller. The parameters controlled, measured and displayed are: gas flow for all MFCs, chamber pressure, directly-coupled RF power level, ICP power lever, reflected power level, dc bias, electrode temperature, process time. System must be capable of automatic operation with manual override.
  - e. The stage must be equipped with a heated lower electrode with a temperature control range of 50C to 450C.
  - f. Gas cabinet/lines: A gas cabinet capable of the following must be supplied. The gas cabinet must be capable of holding 1 ammonia gas cylinder (6" diameter x 19" height) and one 5% silane/95% nitrogen cylinder (6" diameter x 19" height). The mass flow controllers (MFCs) must be contained in either the gas cabinet or in a separate cabinet to be supplied. A total of 5 MFCs must be delivered to handle the following gases: ammonia, the silane mixture, nitrogen, the cleaning gas ( $CF_4$ ), helium, and one spare. Automatic (with manual control option) purging capability of both the silane and ammonia tanks must be provided.
  - g. Pumping system: The pumping system must be designed to handle the necessary corrosive gases and process recipes. Approximate flow conditions for ICP are 300 sccm at 5 mT, but this is process dependent. The pumping system must consist of a combination of turbo-mechanical and backing pump, both capable of corrosive service.
  - h. The system must be equipped with an ICP source.
2. Recipes for deposited films must be provided by the manufacturer. Recipes must indicate techniques used to controlling refractive index, thickness uniformity, and film stress. Recipes must be for both ICP mode and normal plasma deposition mode.

3. Vendor Demonstration – All system capabilities shall be demonstrated by the contractor during the initial installation and will be reviewed prior to final acceptance of the system.

4. Warranty and Support: The contractor must offer the Government at least the same warranty terms, including offers of extended warranties, offered to the general public in customary commercial practice. The warranty begins at the conclusion of installation and training.

5. Installation and Training: The contractor shall provide complete installation and initial operation of equipment. The contractor shall also provide on-site training immediately succeeding the complete installation as described in the procurement. There must be on-site training for at least two operators for 2 – 4 days.