Pacific Northwest
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August 12, 2009

Dear Prospective Offeror:

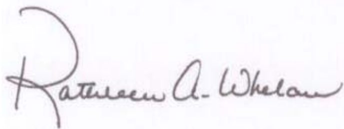
REQUEST FOR PROPOSAL (RFP) NO.104787
INDUCTIVELY COUPLED PLASMA REACTIVE ION ETCHING SYSTEM

This letter serves as Amendment No. 1 to the subject RFP that was issued on July 30, 2009. The purpose of this Amendment is to incorporate the attached, revised Technical Specification dated August 12, 2009. All references to the Technical Specification contained in the subject RFP are construed to mean the Technical Specification dated August 12, 2009. The revised Technical Specification is issued to provide additional information relative to the feature size for the Cryo Deep Si Etch, the Bosch Deep Si Etch and Etching of Pyrex Glass.

Except as provided herein, all terms and conditions of the referenced RFP remain unchanged and in full force and effect.

Offerors shall acknowledge receipt of this Addendum in accordance with the RFP section entitled "Amendments to RFP."

Sincerely,



Kathleen A. Whelan
Sr. Contracts Specialist

Attachment: Technical Specification dated August 12, 2009

Request for Proposal 104787

Technical Specification

Inductively Coupled Plasma Reactive Ion Etching System

August 12, 2009

Scope and Basic Description

This Specification describes the minimum technical requirements and the minimum acceptable performance standards for an inductively coupled plasma reactive ion etching (ICP RIE) system to be installed by the successful contractor at Pacific Northwest National Laboratory, Richland, WA. The ICP RIE will be placed in a multiple user facility within a Class 1000 clean room and must provide ease of use and operation and safety to those in the facility. The tool must be capable of dry etching a variety of materials including silicon, silicon dioxide, various metals and silicon nitride. The system must be computer controlled via menu-driven software and user friendly.

ICP RIE System Features

1. Shall have Bosch (complete with license documentation), mixed gas, and cryogenic etching capability.

2. Shall have a base console to house electronic subsystems, control units, pneumatics, turbomolecular pump, and other support components.

3. Shall have a user-friendly software environment with a dedicated computer for operator interface of process control, wafer handling, real time data logging of process parameters, machine status, recipe management, etc. One additional copy of the software shall be provided for backup purposes; and a minimum of two (2) hard copies of all manuals shall be provided.

4. System shall be fully interlocked to protect the system hardware from any system failure and to protect the operator from any potential hazards, e.g., electrical shock during maintenance procedures.

5. Shall include tooling for 4” and 6” wafers.

6. The deep Si etch process is very sensitive to chamber conditions. To maintain the specifications below for deep Si etch, a spare ICP tube and chamber liners shall be included to be used only for this process. This accessory shall be installed in such a manner for easy access (ex: replacement of tube and liners shall not exceed 4 hours.)

7. Shall have at least five gas lines with appropriate mass flow controllers (MFCs) for the following process gases: C_4F_8, SF_6, CHF_3, Ar, and O_2 with possibility of adding at least one additional MFC and gas line in the future. At least two of the gas lines shall be close coupled to the instrument and equipped with Unit 8100 or equivalent MFCs for Bosch processing.

8. Shall have a remote high-density plasma source providing uniformity suitable for use with wafers up to eight inches in diameter. The RF power should be at least 3 kW.

9. The ICP process chamber shall be equipped with an electrical heating kit for heating the walls to at least 60 ^{o}C to reduce condensation of process byproducts.

10. The lower electrode shall be made of aluminum and capable of heating above ambient temperature and cooling to temperatures as low as -150 ^{o}C. The lower electrode shall have an independent (at least 300 W) RF generator connected through a close-coupled automatic matching unit.

11. Rough pump(s) used to back turbomolecular pump(s) shall be dry pump(s) and hardware required for connection of the pump shall be included.

12. Shall have a load lock chamber for vacuum loading of a single wafer into the process chamber.

13. A standard one-year onsite warranty, including all parts, labor, travel, lodging and expenses, shall be provided for the system. In addition, a minimum of one maintenance service call, including all parts, labor, travel, lodging and expenses, shall be provided.

14. Upon completion of installation, Contractor shall dispatch an applications engineer to EMSL to provide on-site training to a group of at least 3 people and verify process requirements.

Minimum Process Specifications (based on 5 micrometer feature size)

15. Process: **Cryo Deep Si Etch**

15.1. Process Gases: SF_6, O_2

15.2. Etch rate: > 4 um/min

15.3. Selectivity: > 100:1 to photoresist, > 200:1 SiO_2

15.4. Uniformity: < +/- 5% on 150 mm wafer with 7 mm edge exclusion

15.5. Wall profile control: 90° +/- 1°

15.6. Minimum Achievable Aspect Ratio: 30 to 1

15.7. Sidewall Roughness: < 60 nm

16. Process: **Bosch Deep Si Etch**

16.1. Process gases: Octofluorocyclobutane (C_4F_8), SF_6

16.2. Clean gas: O_2

16.3. Etch rate: >2.5 um/min

16.4. Selectivity: >75:1 to photoresist, >150:1 to SiO_2

16.5. Uniformity: < +/-5% on 150 mm wafer (with 7 mm edge exclusion)

16.6. Reproducibility: < +/-3% (run to run)

16.7. Wall profile control: 90° +/- 1°

16.8. Minimum Achievable Aspect ratio: 30 to 1

16.9. Sidewall Roughness: < 200 nm

17. Etching of Pyrex Glass

17.1. Process gases: CHF_3, Ar

17.2. Etch rate: >200 nm/min

17.3. Selectivity: >20:1 to Cr, Ni, or Al

17.4. Uniformity: < +/-5% on 150 mm wafer (with 7 mm edge exclusion)

17.5. Reproducibility: < +/-3% (run to run)

17.6. Wall profile control: $>80^{o}$

17.7. Aspect Ratio: >5:1

17.8. Depth: >50 um

OPTIONS:

Battelle reserves the right to exercise either or all of the following options up to one year following any resulting contract award.

1. One additional ICP tube and associated chamber lines.
2. Year 2 warranty and maintenance (consistent with Year 1 as described above).