

## Lab 2 Copper Sputtering – Variations in Process Parameters

**Name:** \_\_\_\_\_

### **Purpose**

The purpose of this lab is to understand the differences in sputtered film characteristics due to changes in the process parameters, specifically time, pressure and RF power.

### **Required Equipment and Tools**

1. PPTS-1A Plasma Trainer
2. Equipment Manuals including:
  - a. PPTS-1A Manual
  - b. PB-3 RF Power Supply manual
  - c. Magnetron cathode manual
  - d. Vacuum pump manuals (high vacuum turbo pump and mechanical backing pump)
3. Safety glasses
4. Wafer tweezers
5. Substrates (glass or silicon)

### **Part 1: Defining the Experiment**

Develop a matrix of experiments that cover variations in the following parameters (your instructor may select different parameters or assign a subset of values to different teams):

- Pressure: 20, 40, 60 milliTorr
- Deposition Time: 2.5 minutes, 7 minutes
- Power: 50, 100, 150 watts

Be sure to note the target to substrate spacing for your setup.

Using available resources develop an evaluation plan for the produced films. Methods can include:

- Visual: transparency, color, uniformity, texture, etc.
- Microscopic (optical and/or SEM): grain structure, defects
- Adhesion: Scotch™ tape peel test
- Quantified thickness and uniformity: profilometer
- Resistivity (4 point probe)

## Part 2: Setting Equipment Parameters

To minimize the time required to tune the pressure and RF match settings for each experimental run, place a substrate in the chamber and develop acceptable Lead and Gain parameters for each pressure set point and Match Network capacitor settings for each pressure and power level. Record these along with the settings for the Manual Isolation/Throttle Valve. Suggested formats are shown below.

Pressure (mTorr)	Lead	Gain	Valve Setting (Turns from Closed)
20			
40			
60			

Power (W)	Pressure (mTorr)	Tune	Load
50	20		
50	40		
50	60		
100	20		
100	40		
100	60		
150	20		
150	40		
150	60		

## Part 3: Deposition

At this point you are ready to run the experiments. Be as consistent as possible in terms of substrate selection/quality, substrate cleanliness, location of the substrates on the substrate holder (make use of the alignment pins) and general operating procedures.

Record all of your data (including final matching network tuning settings) and note any anomalous conditions.

## Part 4: Analysis and Conclusions

Following your assessment methods that were developed in the Evaluation Plan, detail your findings and any conclusions you might be able to draw. For example, what pressure provided the most uniform films, etc.