ECEn 452 – Semiconductor Devices Lab

Week 2: "Intro to the Cleanroom and Metal Deposition"

Objectives

Pre-lab questions

1. Which is cleaner, a class 100 or a class 10 clean room?
2. What exactly does a "class 100" clean room mean?
3. What generally does an e-beam evaporator accomplish?
4. What is the ideal vacuum condition for an e-beam evaporator (how low should the pressure be)?
5. Briefly describe how an oil diffusion pump operates.

Objectives

1. Particle Counts:

Measure particle counts inside and outside of the cleanroom using the laser particle counter. Determine the classifications inside and outside of the cleanroom – are we Class 10, Class 100, Class 1000 inside?

2. Nickel Evaporation Using E-beam Evaporator:

Using the e-beam evaporator, evaporate 100 nm of Nickel on 4 inch silicon wafers. You will be given special wafers with fairly high doping levels. Do a short Buffered HF dip of the wafers before loading them in the evaporator. The lab supervisor or TA will guide you through this dipping process as well as the evaporation. Document in your lab notebooks the important parts of this process. Why do you do the HF dip before evaporation?

3. Aluminum Evaporation Using Thermal Evaporator:

Using the thermal evaporator, evaporate 100 nm of Aluminum on 4 in silicon wafers. You will be given special wafers with fairly high doping levels. Do a short Buffered HF dip of the wafers before loading them in the evaporator. The lab supervisor or TA will guide you through this dipping process as well as the evaporation. Document in your lab notebooks the important parts of this process. How is thermal evaporation different from e-beam evaporation?

4. Vacuum Systems:

Because high vacuum systems are important to many processes in the cleanroom, you should investigate different types of vacuum pumps. Identify the following types in the cleanroom and determine how they work:

- Mechanical
- Turbo
- Cryo
- Diffusion

The lab supervisor and TA's will be available to answer questions about the many pumps in use. Compare the lowest pressures achievable for these different types of pumps

5. Resistivity:

Using the 4 point probe, measure the resistivity of silicon wafers with and without metal coatings on the surface.

6. Surface Features:

Examine the features of metal evaporated on the surface of your silicon wafers under a high power microscope. Draw any features in your notebook. Estimate the size scale of these features.

The above objectives were not necessarily meant to be accomplished in a particular order. For example, several objectives could be accomplished while waiting for adequate pump pressures in Objectives 2 and 3.