Formation and Growth of Gold and Gallium Nanoparticles on Silicon (100)

Garett Milton, Advisor: Dr. Samuel Tobler

**Sample Prep**
- Silicon (100)
- 5 mm x 10 mm
- Molybdenum Holding Clips
- Electrical Contact
- Vacuum Chamber
- Diffusion Pump (messy oil)
- Degas sample at 500°C
- Dose metal
  - Au
  - Ga

**Mounting Samples**
- Au
- Wrapped Around Tungsten
- Ga
- Heating

**Motivation**
- 1-D objects
- Manipulation of materials
- Bottom-Up Idea
- Multiple Materials
  - Gold
  - Gallium
  - Silver

**Experiment**

**Procedures**
- Cut and mount silicon
- Place in chamber and establish vacuum
- Degas silicon
- Determine temperatures
- Dose silicon with metal
- Scan with SEM/AFM

**Temperatures**
- Resistivity heating
- Optical pyrometer
- Degas at 500°C
- Dose at 800-900°C

**Dosing**
- Gold for between 30-60 sec
- Gallium for 60 sec
- Metals sublime onto the silicon surface

**Black Body**
- Glowing samples
- Peak intensity depends on temperature
- Intensity of red wavelength
- Disappearing Filament Optical Pyrometer
  - \( T > 780°C \)
  - 500°C barely visible in dark room
  - Accurate to less than 10 degrees

**Disappearing Filament Pyrometer**
- For an ideal black body emission equals absorption
- Very specific wavelength will be different at certain temperatures
- Therefore two bodies with same intensity and same wavelength must be the same temperature

**Body Dot Size vs Temperature**
- Gold dots increase with temperature
- Gallium dots do not appear to change size with temperature
- Not uniform coverage
- Repeatable

**Si Nanowires**

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A temperature gradient was occurring because we were not getting uniform heating from the bigger clips. See Gold at 800°C

**Gallium at 800°C**

**Gold at 800°C**

**Gallium at 850°C**

**Gold at 900°C**

**Gallium at 900°C**

2 μm

Average Size: 129.9 nm

2 μm

Average Size: 129 nm

2 μm

Average Size: 129.9 nm