



Constructing a Lab

A Story of Progress with Professor Manfra's MBE.

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Advisor: Prof. Manfra

A Brief Outline:

- Little recap of big picture.
- What happened to my projects?
- What else did I do?
- What can I take away from this experience?

Recap:

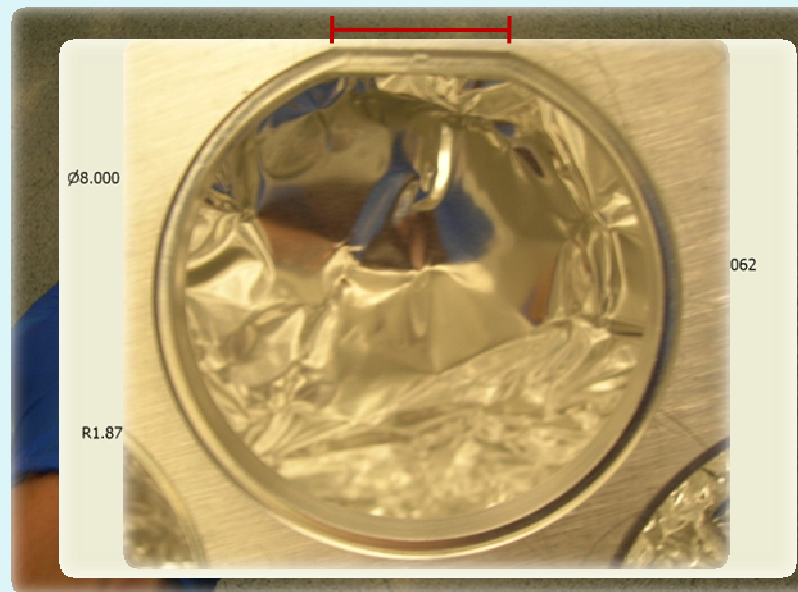
- What's Prof. Manfra's lab doing again?
- Where was I supposed to fit in?

Primary Project:

- Coat sapphire wafers with thin film of Tungsten-Silicide
- Series of steps:
 - Design sample holder
 - Machine sample holder
 - Install WSi_2 target into sputtering system
 - Manipulate sputtering conditions to produce suitable layer

Primary Project:

- Already discussed design
- Machining took two attempts
 - Indicated length of flat side was originally cut too short



And the next steps...

- Never occurred.
- Repeated delays with the target manufacturing process

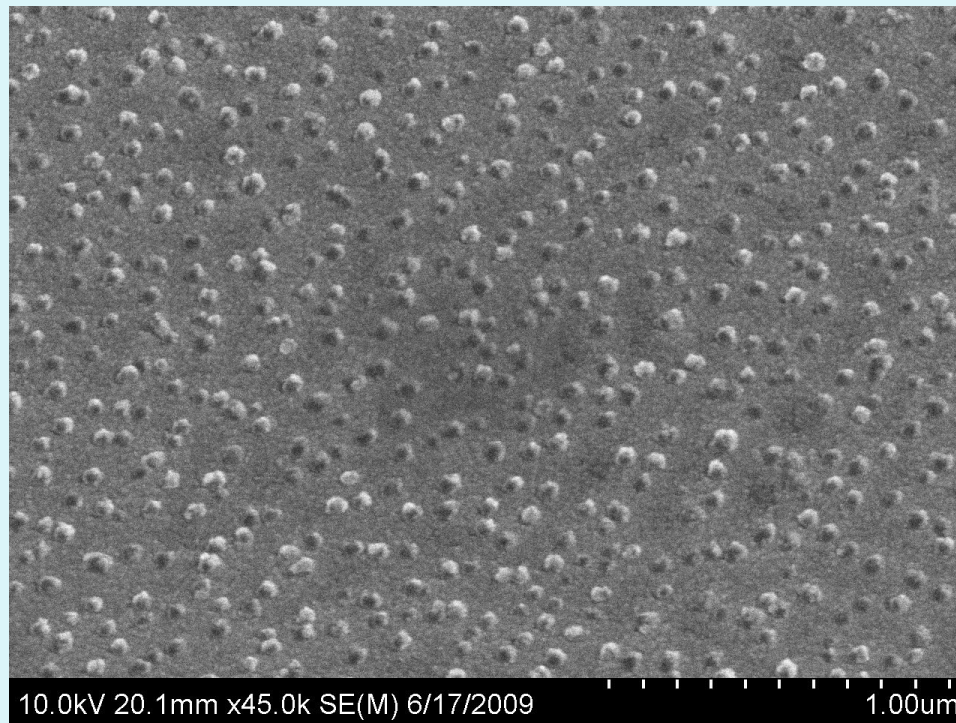


Secondary Project:

- Image previous growths with Scanning Electron Microscope
- Only one development with this project since my mid-term talk

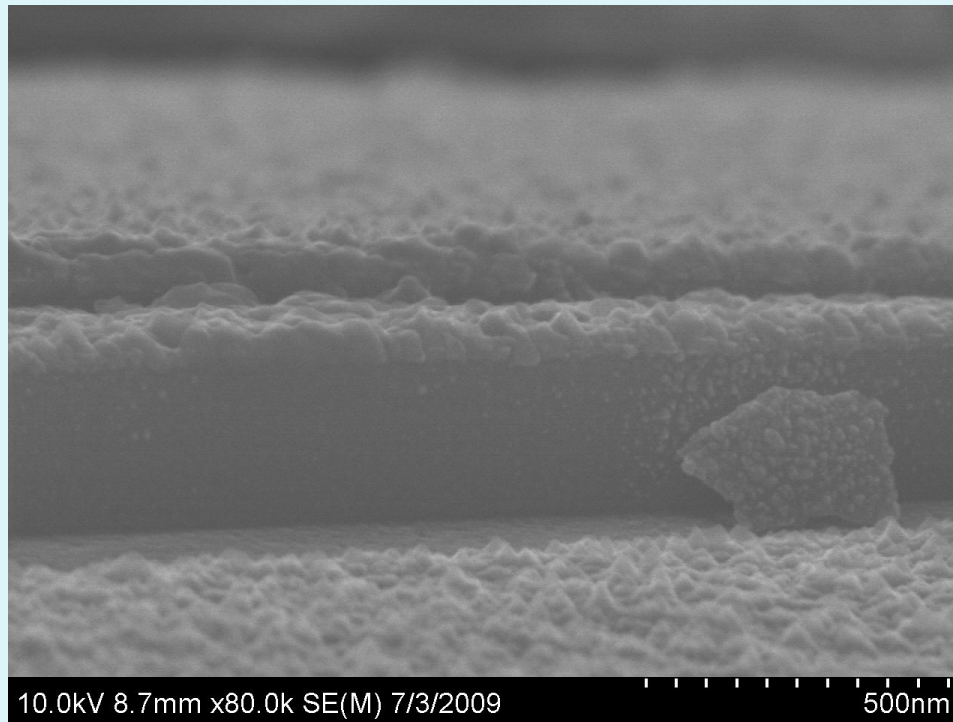
Secondary Project:

- Recall what I had seen
 - Can't tell much from this angle



Secondary Project:

- So I had to try and get a picture from the side



And some thoughts...

- From the side, it's even more clear these aren't nanowires
- Could be the start of them, however
 - Literature suggests nanowires take much longer time to form

Tertiary Project:

- Prepare our machine for research-grade MBE operations
- Majority of my time was spent on this

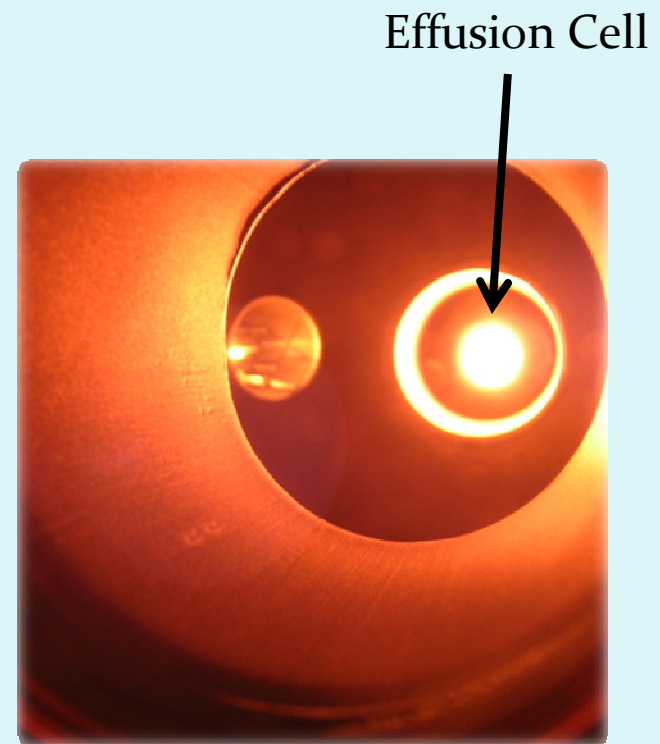


Tertiary Project:

- Preparing general system:
 - Align transfer arms
 - Retrieve dropped pieces from failed alignments...
 - Install sources
 - Nitrogen, Carbon
 - Already discussed bake-outs
 - Important to keep uniform heat

Tertiary Project:

- Preparing the Aluminum cell
 - Crucible Cleaning
 - Cell Cleaning
- Prep chamber sees action!

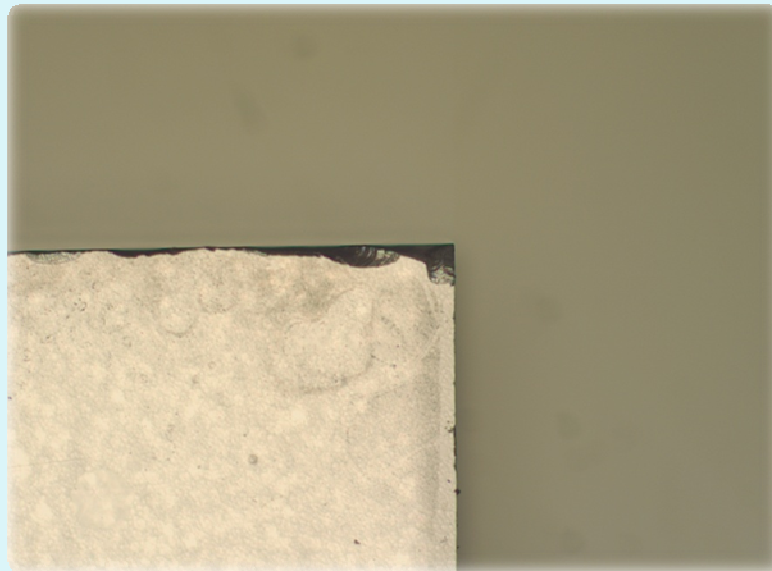


Tertiary Project:

- Testing of Ultra-Pure Argon gas
 - Bake out newly installed Argon lines
 - Pass high-purity Argon gas through gettering furnace
- Fill growth chamber, empty growth chamber, and cross our fingers
 - Base pressure before: 5×10^{-11} Torr
 - Base pressure after: 8×10^{-11} Torr

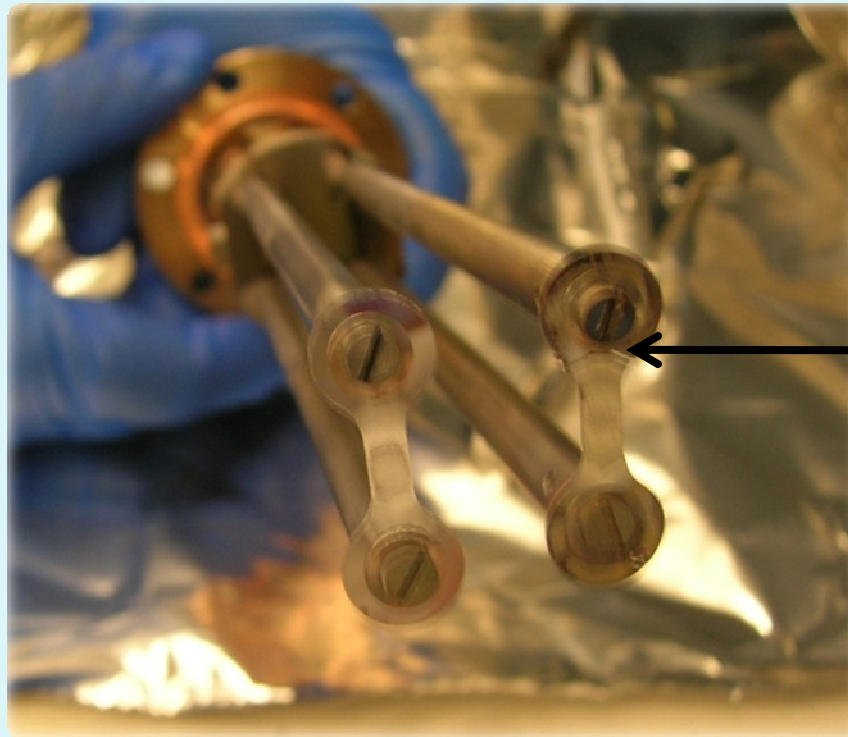
Tertiary Project:

- Random things you might not think of...
 - How do you cut samples to fit in growth chamber?
 - How do you remove the adhesive residue after previous step?



Tertiary Project:

- Random things you might not think of...
 - How do you build a Silicon filament?

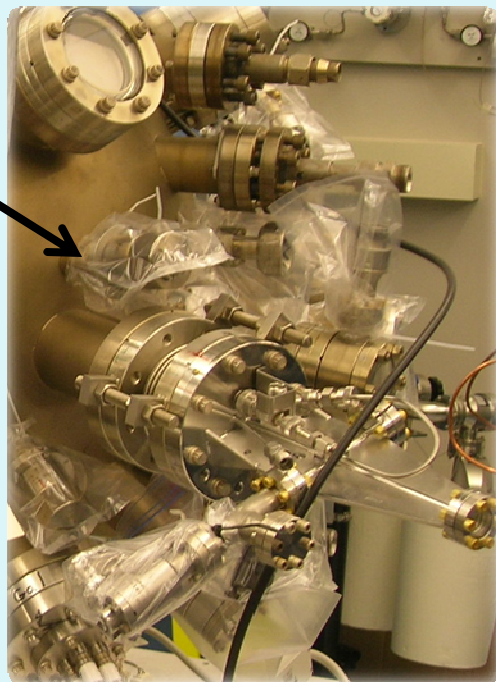


Cracked
Filament

Tertiary Project:

- Random things you might not think of...
 - How do you track down leaks at 5×10^{-10} Torr?

Leak Check
Bags



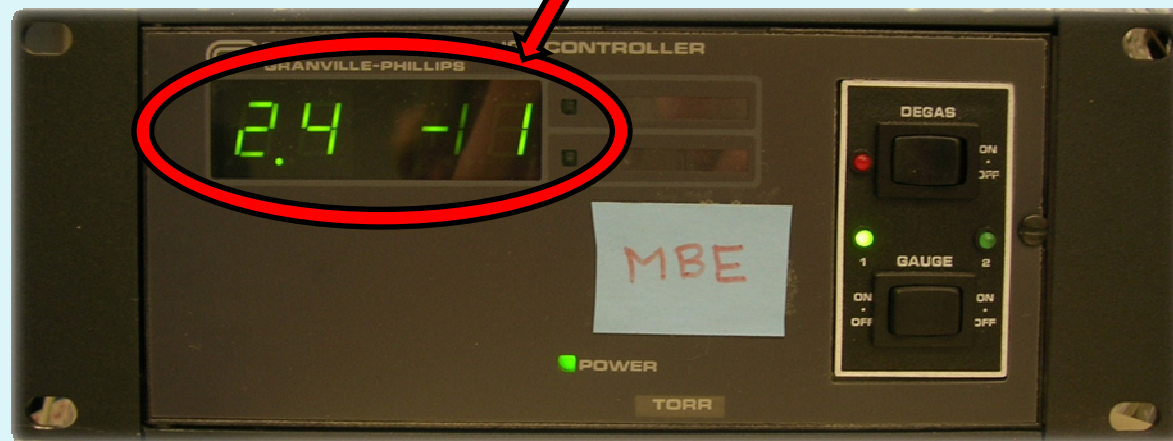
Tertiary Project:

- Random things you might not think of...
 - Manufacturers don't believe in providing cables with their products.

Was My Summer Productive?

- There are multiple phases of a complete research project
- Much progress made on system pressure and lab readiness

Misleading Pressure
Propaganda



Much Thanks Extended To:

- Professor Mike Manfra
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- Discovery Park
- Purdue University
- NSF

Questions?

