Formation of Nanowires Through a CVD System
Brandon Yang (mentor Jaeyun Moon)
Department of Engineering

How to Create Nanowires.

There are two ways to form a nanowire. It can created from "top-down" or "bottom-up."

Top-down is when a normal fiber-optic cable is heated and stretched to the point where it is as thin as a nanowire.

Bottom-up, the method used in the experiment, is the use of a CVD (Chemical Vapor Deposition). This is when a catalyst layer is placed on a base and the heated and exposed to a gas. The catalyst is used to attract the gas to the plate and the nanowires form themselves.

Possible Errors

• Residual particles on the sample when adding the catalyst to the plate.
• The heating tube had to be replaced in the middle of the experiment. Particles may have been left behind. Also, the replacement may have been installed incorrectly, allowing air to seep in.
• Uneven distribution of the powder on the base between samples.

Conclusion

• With SiGe samples, no nanowires were immediately observed. However, under the electron microscope, some were found.
• With Bi samples, large amounts of nanowires were discovered around 250 C.
• The starting temperature for nanowire growth for Bi is around 245 C.
• The samples must slightly melt into individual spheres for the wires to grow.

Further Experimentation

• What is the reason behind the color change for bismuth?
• Why are the spheres needed for nanowire growth?
• Under what conditions affecting SiGe will create similar results with Bi?

Prior to my experiment, wires were found in SiGe, but with a different hydrogen to argon ratio. The change in ratio may be the reason for impaired growth of wires.