

ECEn 555 – Optoelectronic Devices Lab

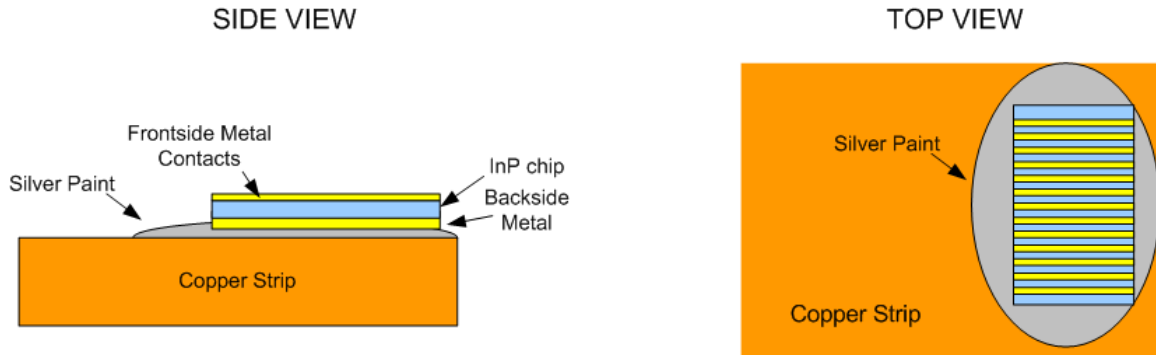
Week 12/13

“Laser Diodes – Fabrication Completion/Testing”

In this lab you will complete the construction of your laser diodes. This will consist of depositing gold on the backside of the wafers and then cleaving them into thin pieces with multiple laser “bars” on each piece. You will then test the optical output power of your laser vs. input current and voltage using a detector that is sensitive to the 1.3 micron light emitted by the laser.

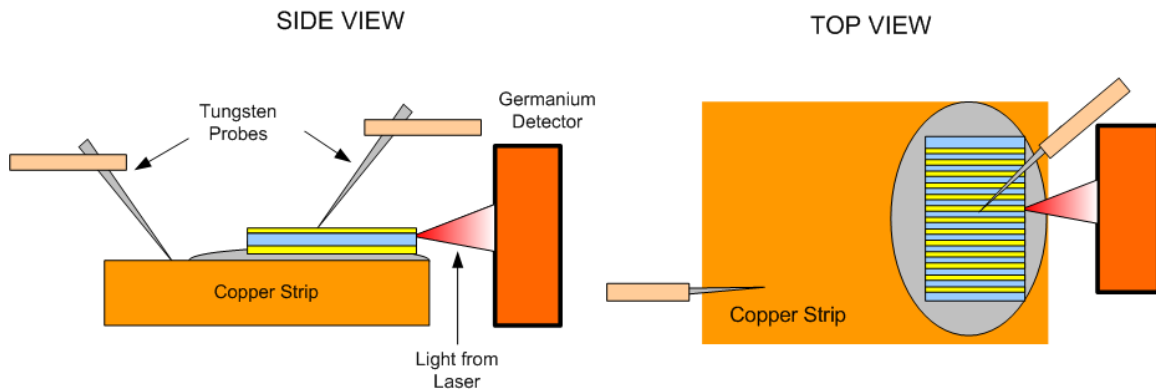
Major Objectives

1. Au Metallization. At the completion of your last lab session, your laser material should have been lapped to approximately 150 microns and still be attached to a silicon piece with crystal wax. Clean off the backside of your wafer with acetone and a q-tip and then do a quick dip in buffered HF. Load your sample into the thermal evaporator along with a chrome coated tungsten rod and pure gold pellets in a tungsten boat. Evaporate 15 nm of chrome and as much pure gold as possible on your sample.
2. Removal From Silicon Piece. Using a hotplate, heat up your samples to 120C so that you can remove the InP pieces. When the wax has liquefied, slide your InP off and catch it in filter paper (as you did in the practice lab two weeks ago).
3. Cleaving. As you did in the previous practice lab, place your InP samples with the striped side face up on a piece of Nitto tape. Scratch the edge of your sample using the cleaving tool at about 500 micron intervals. After scratching, pull the tape apart as you roll it across a flat surface. This should cause the edges to cleave along your scratch points.
4. Placing on Copper Strips. Carefully pick your cleaved pieces from the scotch tape and place them on the edge of copper strips so that you have a convenient structure to use for testing your lasers. Mount the pieces near the edge of the copper using some silver paint. The silver paint cannot be very thick however or it will cover the output facets of your lasers. This will be a very tricky step and will most likely require several practice attempts because you will have to kind of push your tiny chips into place and will have to ensure that the silver paint is really thin. The diagram below shows a top and side view of what your laser bars should look like when mounted onto the copper strips.



5. Measuring Laser Length. Now that your laser bars are mounted to copper strips, use a microscope and ruler to estimate the total length of your laser cavity. This is probably best done in the cleanroom using the optical microscope that has a CCD camera attached.

6. Laser Testing. This step will require the use of the optoelectronics probe station. You will place your copper strips that have laser bars mounted to them on the edge of the probe station. Use the tungsten probes to contact the top of an individual laser and the copper plate. Position the infrared detector so that you can measure the output from the facet of the laser – this detector will be a commercial unit that will read out absolute light intensity. You will apply current and measure voltage through the laser using the power supply next to the probe station. The diagram below shows how you will contact your lasers and position your photodiode.



7. Laser Measurements. Make the following measurements for your working lasers:
 - Light output power vs. laser drive current
 - Light output power vs. voltage across laser
 - Threshold current
 - Slope of output power vs. current curve beyond threshold
 - Report these quantities vs. cavity lengths and report any trends
 - Determine and report the maximum power conversion you measure for a laser (light output compared to electrical input power)