ME141B/ME292
Mark Design Homework
Fall 2010 DUE10/14/2010

In this assignment, you will be designing the first mask of a two mask set that involves a microfluidic chip with integrated electrodes. We have provided the Mask that outlines the metal electrodes, and your assignment is to design the mask for the microfluidic channel. The mask that we provide to you is the same as the one you are using for your lab work. Therefore, the first part of this assignment is just to characterize the mask and understand all the dimensions. This tests your knowledge of manipulating L-edit as well as helps you understand the lab mask in more detail. This is not otherwise related to the rest of your mask design assignment.

BACKGROUND: The device for this assignment is a glass microfluidic device with integrated electrodes. This is accomplished by bonding 2 glass wafers together: one side has etched channels + deposited metal electrodes, and the second is a blank wafer with 1.4mm diameter drilled access holes. You will be designing the first mask with the microchannel layout and appropriate alignment marks.

Step 1: Study the L-edit files provide to you:

a. electrodes.tbd (and electrodes.gds) is the layout file for the second mask in the process. It consists of 5 square features spaced 5mm apart from each other. Sketch the layout and label the dimensions.
b. align.tbd (and align.gds) has the alignment marks which you will use to align the masks. Sketch these alignment marks and write down their dimensions.

Step 2: You will now be designing the first mask for the process

a. Design a cross channel that is 30 mm wide and has channel lengths of 5mm for the north, west and south channels and 30mm for the east channel (Figure 1). Create 2mm diameter circles at each inlet for the channel for reservoirs. If desired, create tick marks/scale bar underneath the channel (See Figure 3). If you plan to do this, think carefully about how thick you want the lines (they cannot be infinitely thin, and how this is going to affect your processing.) Either way (if you include them or not) please explain why or why not and the pros and cons of including this in your design.

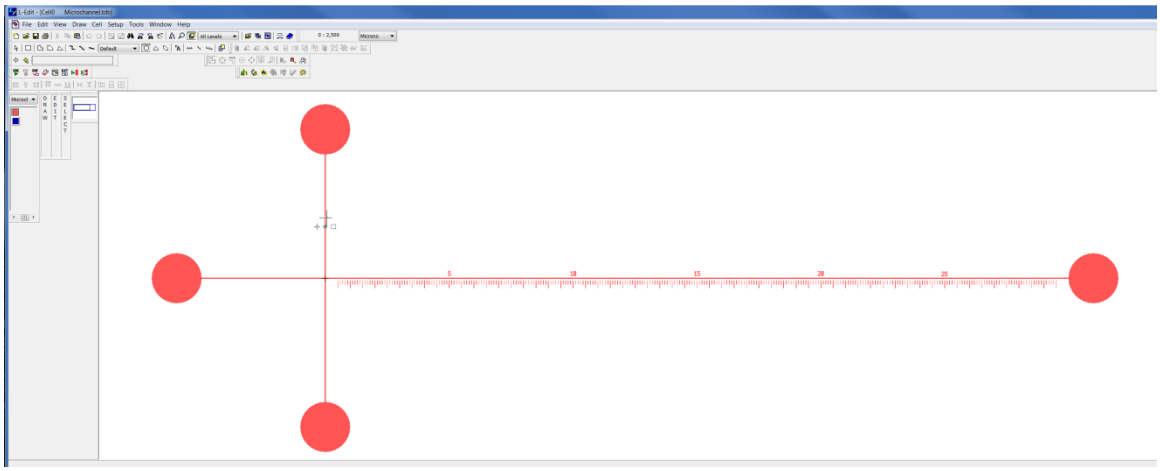

Figure 1: Cross channel geometry

Step 3: Next you need to combine the fluidic and electrode masks so that the electrodes sit in the center of the channel at 5 (Figure 3), 10, 15, 20, and 25mm down the east channel. You also need to add the provided alignment marks (for the electrode layer) and design compatible alignment marks in the fluidic layer.

You need to specify what polarity the mask will be (darkfield or brightfield) as well as the type of photoresist you will use for each process step (positive or negative tone). When choosing your mask polarity, think about what you will be seeing when doing top side alignment.

a. Read the document provided on alignment and design alignment marks using the align.tbd file as reference. Make use of Cells and Instances
b. Combine the fluidic layout from step 2 with the electrodes.tdb file as described above
c. Add appropriate alignment marks
d. Specifiy mask and photoresist polarities

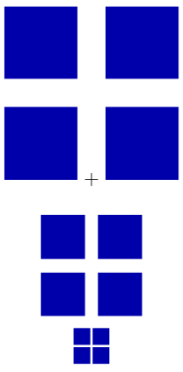

Figure 2: Align.tdb

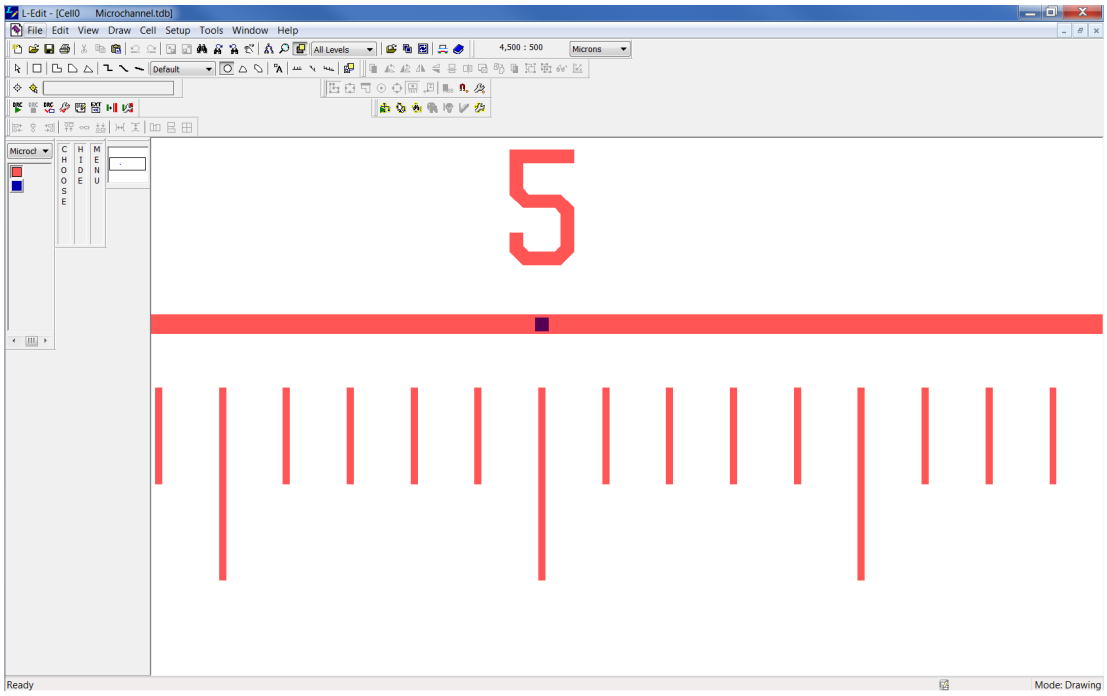

Figure 3: Channel-electrode alignment

Finally, draw a 50.8 mm x 25.4 mm rectangular boundary (1mm thick) around your pattern (on the fluidic layer). On the inside lower right corner of this boundary, put your initials (e.g. JP for Joe Plumber) with each character 2 mm high. Assign GDS #1 to the fluidic layer and GDS #2 to the electrode layer.

Save as lastname_firstname_hw1.tdb and export as GDSII with the same naming scheme.

Step 4: Custom design

In this step you will create your own design around the prepositioned electrodes provided. Design the mask in such a way that the electrodes will provide a function (ie. concentration, detection, electrokinetic phenomena, etc…). Examples include: (1) looking at concentration/adsorption around floating potential electrodes in a straight channel, or (2) using a cross channel geometry to concentrate right at the center.

a. Design your own mask that integrates (and uses) the electrodes in electrodes.tdb
b. Explain how/why the electrode is being used and what you can learn/study by using your geometry

Finally, draw a 50.8 mm x 25.4 mm rectangular boundary (1mm thick) around your pattern (on the fluidic layer). On the inside lower right corner of this boundary, put your initials (e.g. JP for Joe Plumber) with each character 2 mm high. Assign GDS #1 to the fluidic layer and GDS #2 to the electrode layer.

Save as lastname_firstname_hw1CUSTOM.tdb and export as GDSII with the same naming scheme.

Please e-mail me the 2 .tbd files and turn in the sketches and the answers to the two questions above in class on 10/14.