Working in the cleanroom

Dear students,

This guide shall give you some useful information and guidelines to start working in the cleanroom. You will be working in the Neural Microsystems Platform (NMP) cleanroom at Campus Biotech, Geneva. The cleanroom facility is located in the B3.2 floor of the building. The fabrication of your devices should be done in the main plasma/thin film area and in the photolithography area, if you need for some specific reasons some tools which are not shown during the initial training, then contact the appropriate NMP staff or the microfabrication TAs (Staff: jeremy.laedermann@fcbg.ch // TAs: Laurine Kolly, Valentina Paggi, Yashwanth Vyza)

As a general rule, it is always better to ask first than just trying something out. In every zone you have telephones and a list with the staff people; they are very helpful and can solve almost all your problems. For all the equipment, there are manuals available close to it with very precise step by step guidelines. Especially in the beginning you should make use of them to get used to the tools. Also you should take notes when you get trained on a tool, so that if something isn't clear in a later state, you can refer to these notes. Your main work in the cleanroom will be related to photoresist on Polyimide (PI). Before you start you should think about how you want to proceed and you should have an idea of a process flow that you want to follow to realize your devices. After this, it would be a good idea to talk with one of the cleanroom teaching assistants, so that we can give you some advice, tell you if you should take care of some elements or if something won't be possible to realize.

To design your layout, you can use almost any tool that can generate a DXF, GDS or CIF file. Examples of such software are AutoCAD or KLayout, some of you might already know them. Although there is more elaborate software, you can realize everything with these and, if you need, we can give you an introduction to them. You can download AutoCAD for free with your EPFL student email address. KLayout is also free to download. If you choose to use AutoCAD you will need to save your file in DXF and make sure all lines are closed in KLayout (check the CMi guide on this). If you have any questions or problems, don't hesitate to ask. And one thing to remember before you start with your design, think about your process and the tone of your resist, so that you won't have to invert your design later. As a hint, you will be working initially with a positive film photoresist. As you progress in your project you may change the thickness or tone (positive vs negative) of your photoresist, keep this in mind for your mask design.

Once you designed your mask, send it first to us (the TAs) and we will make sure there are no design errors and it can be properly converted. After this initial iteration please send the final corrected design with the following information:

Subject: LiT 2022 project "Team_name"
To: cleanroom TAs
CC: jeremy.laedermann@fcbg.ch
DXF attached in message

There will be an initial check done and your Cr mask will be prepared the day before you plan on coming to the cleanroom. Price will be 25 CHF/mask + Operator rate (40 CHF/hour on various equipment) for a total around 50 CHF. The writing area will be limited to a square of 70x70 mm^2. Any

object smaller than 3um in size will be ignored (Critical Dimension). Relative position accuracy (Fabrication grid) is 500nm.

For the metallization part, the AC 450 sputtering tool will be used. For details and available metal targets please have a look at the manual in the cleanroom. Available targets are: Al, TiN, Si, ITO, Pt, SiO2, Ir, Ti, Cr, Mo, PtIr, Au, Al2O3, Ni, Cu, MgO. The AC450 tool is for single wafer processing and most metals are included in the general tool cost (44 CHF/hour). Additional cost will apply for precious metals such as platinum or gold. These will be communicated to you, depending on your choice of metals. Once you get trained on the tool you will have access to the weekly doodle to vote for your desired sputter target configuration. Targets are always changed on Wednesdays and occasionally on Mondays. Do not vote for a target if you have no intention of using it that week.

Concerning the metals to use, you're free to try any metal that is available on the AC450 tool. To make sure that there will be enough adhesion of the metal layer to the PI substrate it is highly advised to put a suitable metal layer underneath your main metal, acting as adhesion layer. You will also explore other techniques to improve adhesion throughout your project.

To get started you should start working on your design and prepare your masks. In parallel, you should think about how to fabricate the devices and which steps will be involved. Once you have a first draft of the mask and the process you should contact the cleanroom TAs to help you review the process and the design. Then you can order your mask and you can ask to get trained on the different tools in NMP. When you design your device, make sure to use resistivities for thin film material and not the one for bulk if possible, or take into account that the resistivity of your design will be higher than the theoretical one.

You will need some wafers that will act as a support during fabrication. For this you can get regular Si wafers with Al release layer from us. If anyhow you want to use different wafers for some particular reason, you can tell us and we can provide them to you.

To sum up, here is a list of the costs that will be accumulated during your work in the NMP.

Step	Cost (CHF/hour)
Photoresist coater and developper	47
MJB4 (photolithography exposure machine)	30
AC 450 (metal sputtering)	44
Mask	Approx. 50 (1 unit)
Si + Ti/Al wafer	27 (1 unit)
Si wafer	12 (1 unit)

References:

Course notes from "Technologie des microstructures" M.Gijs and J.Brugger
"Fundamentals of microfabrication" 2nd or 3rd edition by M.J. Madou
CMi homepage https://www.epfl.ch/research/facilities/cmi/
Cleanroom extranet https://extranet.campusbiotech.ch/resource/cleanroom