OFET TEST CHIPS HIGH DENSITY

FABRICATION GUIDE

Manual version: 1.0.C

Contents

1. Overview

This guide contains instructions for fabricating high-density OFET test chips using Ossila's deposition mask for high-density OFETs. Fabrication should be performed in a clean environment if possible, as small particulates or dust can cause shorting of the OFET channels.

1.1 Requirements

- Silicon oxide substrates (**S146 / S148**)
- Tweezers (**C121**)
- Substrate rack for cleaning and storage (**E101**)
- Annealing and cleaning beaker (**C191**)
- Hellmanex III for critical cleaning (**C141**)
- Ultrasonic cleaner
- Source-Drain Deposition Mask, High Density (**E321 / E322 / E323**)
- Evaporation stack - high-density OFETs (**E312**)
- Thermal evaporator
- De-ionised (DI) water
- Chromium and gold evaporation sources

2. Substrate Preparation

1. Make sure that tweezers, substrates rack, cleaning beaker, and all glassware are properly cleaned.
    I. Use a dedicated crystallising dish (glass beaker) for each step of the cleaning routing.
    II. Rinse the tweezers with acetone, IPA and then blow dry with N_2 gun.
2. Separate the desired number of substrates from the silicon wafer.
3. Load the substrates into a substrate rack, making sure that all substrates have the mirror-polished side facing the same direction.
    I. Keep note of this direction so to avoid touching the mirror-polished side when moving the rack.

2.1 Substrate Cleaning

1. Sonicate in hot (70 – 80 °C) 1% Hellmanex III solution for 5 minutes.
2. Rinse thoroughly twice in hot DI water.
3. Sonicate in IPA for 5 minutes.
4. Rinse thoroughly twice in cold DI water.
5. Store in cold DI water (for up to 12 hours) until ready to load into the evaporation stack.

3. Evaporation Preparation

3.1 Loading Deposition Masks

1. Check that the deposition masks are free of dust or residue, and that features are undamaged.
2. Using tweezers, carefully place the deposition masks into the substrate holder.

3.2 Loading Substrates

1. Using tweezers, take a substrate and blow dry it using N_2.
    I. Ensure the entire substrate is dry, including the back and edges.
    II. Try to avoid touching areas of the substrate where deposition will occur.
2. Carefully place the substrate into one of the slots of the substrate holder.
3. Once all substrates have been loaded, carefully place the lid on top of the evaporation stack.
4. Add the nuts to the screws and gently tighten them to fasten the stack together.
5. Place the magnetic sheet on the back of the lid.
6. The assembled evaporation stack should be as shown in **Figure 3.1**.

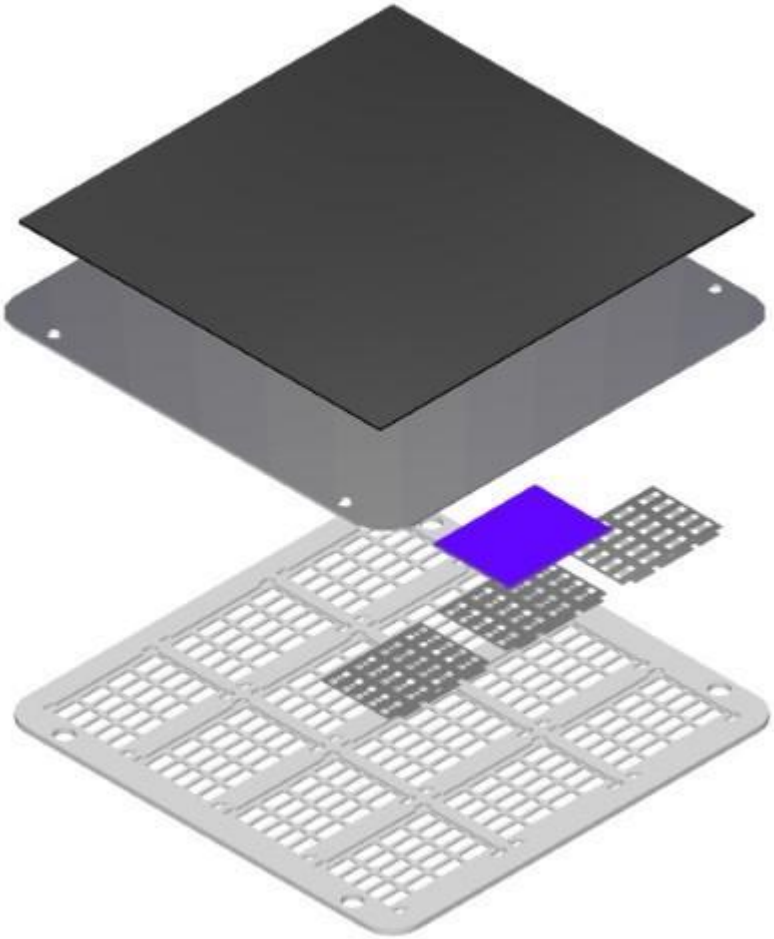

Figure 3.1. High-density evaporation stack assembly.

4. Evaporation

1. Load the evaporation stack, chromium source, and gold source into the evaporator and pump it down to typical evaporation pressure.
2. If available, start the evaporation stack rotation.
3. Evaporate 1 – 2 nm of chromium.
    I. Note, chromium forms a layer of chromium oxide on its surface. This will cause an increase in pressure as it heats up. Deposition of chromium should not be started until the pressure returns to normal, indicating this layer has been removed.
4. Wait 5 – 10 minutes for the chromium to cool.
5. Deposit 60 – 70 nm of gold.
6. Wait 5 – 10 minutes for the gold to cool.
7. Vent the evaporator and remove the evaporation stack.

5. Quality Check

To check that the test chips have deposited correctly, they can be inspected with a microscope and a multimeter.

When inspected under microscope the channels should be well defined, with nothing bridging the gap between the source and drain electrodes, as shown in **Figure 5.1** below. Additionally, a multimeter can be used to check that there is no electrical connection between the source and drain electrodes.

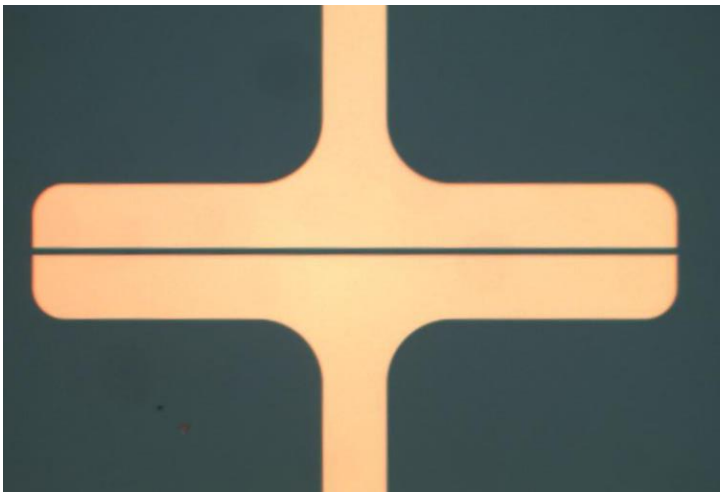

Figure 5.1. Example of how an OFET channel should look.

If any dust or particulate is seen or an electrical connection measured, first try using N_2 to remove it. If that does not work, try to gently clean the channel using IPA and a cotton bud or cleanroom paper.

The quality of the gate electrodes can be checked using a multimeter. Simply place a probe on each of the gate electrodes and measure the resistance. It should be no higher than a few 10s of Ohms.