

Washing and Sterilizing Silicon Chips for MIMS Analysis

SILICON WAFERS:

- Purchased from: Montco Silicon Technologies, Inc., Spring City, PA. Contact: Susan Coder - (610)948-6880. The price per silicon wafer is ~\$15.00 when purchased in a case of 25 wafers.
- Silicon wafers are ~9.8cm (4") in diameter. They are doped with N/Antimony (111). Parameters: Resistivity = 0.005-0.020 ohm·cm; Thickness = 475-575mm (525mm as measured by JCP); Weight = 30mg (weighed by PK).
- Silicon wafers are diced into 4.950 mm squares at MIT in the Microsystems Technology Laboratories in Cambridge, MA. Contact: Dan Adams -(617)253-0086.
- It is essential that the wafers are diced with high precision because they must fit precisely into the sample holder custom-built for MIMS analysis.

POTENTIAL APPLICATIONS:

- Epon sliced sections mounted for MIMS Analysis.
- Cells can be cultured directly on flamed clean silicon chips.

MATERIALS:

- Silicon wafer diced into (4.950mm)² Si-chip pieces
- Misonix Sonicator 3000 with ~1/2" probe, ear protection.
- Rectangular base ring stand
- Sterile Petri dishes (Fisher Scientific-Falcon Standard dishes, 100 mm and 150 mm diameter)
- 600ml clean beakers (at least 6 total)
- Magnetic stirrer, magnetic stir bars
- Wire mesh strainer
- Teflon tipped forceps
- Powder free gloves
- Acetone (Sigma-Aldrich #154598, ACS spectrophotometric grade ≥99.5%)
- Methanol (Sigma-Aldrich #M3641, ACS spectrophotometric grade ≥99%)
- Isopropanol (Sigma-Aldrich #154970, ACS spectrophotometric grade ≥99.5%)
- 0.2micron-filtered Ethanol (Sigma-Aldrich #493546, (200-Proof) USP/NF)
- Water, ultra pure, spectrophotometric grade (Alfa Aesar, #19391) -Can substitute with 0.2micron-filtered distilled water
- Argon or Nitrogen gas

CLEANING PROCEDURE (READ: GENERAL NOTES before proceeding):

1. Place 75 silicon chips into the wire mesh strainer (each weighs 30mg).
2. Place a magnetic stirring bar into a clean 600mL glass beaker followed by the strainer containing the chips.
3. Add 250mL Acetone into the beaker fully submerging the Si-chips.
4. Turn on the magnetic stirrer (setting 2.5 or 3 on dial) and stir moderately for ½-¾ hour. Turn off the magnetic stirrer once the time has elapsed.
5. Using the Misonix Sonicator 3000 with the 1/2" probe, sonicate the Si-chips, without stirring, at a power setting of 18-21W (setting 1.0 or 1.5 on dial) for 2 minutes. Note: The Misonix Sonicator 3000 has a timer.
6. Pour off the Acetone and discard into a container in the satellite accumulation area. Transfer the strainer into a clean beaker and add 250mL Methanol and repeat the sonication step as above.

7. Pour off the Methanol and discard into a container in the satellite accumulation area. Transfer the strainer to a clean beaker and add 250mL Isopropanol and repeat the sonication step as above.
8. Pour off the Isopropanol and discard into a container in the satellite accumulation area. Transfer the strainer into a used beaker.
9. Rinse the Si-chips with 900mL (300mL x 3) of 0.2micron-filtered distilled water, ensuring the flow-through does not touch the chips. Gently agitate so that all of the chips are rinsed. Remove the strainer containing the Si-chips from the water and discard the water. Place a magnetic stirring bar into the glass beaker followed by the strainer with the Si-chips.
10. Add 250mL of 0.2micron-filtered distilled water into the beaker fully submerging the Si-chips. Turn on the magnetic stirrer (setting 2.5 or 3 on dial) and stir moderately for ½ hour. Turn off the magnetic stirrer.
11. Remove the strainer from the water and transfer to a used beaker. Rinse the Si-chips thoroughly with 200mL of the 0.2micron-filtered ethanol.
12. Transfer the Si-chips into a clean sterile Petri dish. This is done by inverting the wire mesh strainer over the Petri dish and gently tapping it so that the Si-chips fall into the Petri dish.
13. Pour 0.2micron-filtered ethanol into the Petri dish completely submerging the Si-chips. Flip the Si-chips so that they all have their mirrored surfaces facing upwards.
14. Use a cotton-tipped applicator to gently scrub each mirrored surface while it is fully submerged in ethanol.
15. Transfer each Si-chip into a clean Petri dish and dry the mirrored surface with a stream of dry filtered nitrogen gas.
16. Count and place the clean Si-chips in the desiccator located in the tissue culture lab (Rm 538).

GENERAL NOTES:

- TP obtained a sink strainer from the hardware store (~ 4" in diameter), removed the stiff wire rim, and attached some metal "strings" to allow one to lift the strainer from the beaker. The unrimmed strainer fits snugly into a standard 600ml glass beaker and can be placed securely at any depth.
- To conserve materials, secure the strainer close to the bottom of the beaker allowing enough room for a magnetic stirring bar to rotate freely at the bottom.
- The diced silicon wafer is shipped and received while attached to dicing tape (blue). Flex the wafer to crack the remaining wafer remnants at the bottom of the channels, if any. You may specify dicing completely through the wafer, which can be messy, or dicing to just above the bottom surface, which is much cleaner. However, no significant difference in the appearance of the final washed chips has been noted.
- Remove the non-square Si-chip fragments from the periphery of the wafer and discard. There may be vaporized dicing tape/adhesive that has deposited on the peripheral chips in variable amounts. Remove and place these chips in another beaker for separate cleaning if desired.
- Vacuum clean the top surface and channels with a trimmed disposable pipette tip attached to a vacuum trap to remove silicon sawdust and fragments. With gloves on, roll the dicing tape away from the Si-chips and carefully peel them from the tape, prying them away from the bottom surface and away from the remaining Si-chips, with a Teflon-tipped forcep. Place into a sterile clean 150 mm diameter Petri dish.
- A photoresist can be added to the wafer prior to dicing to protect the wafer surface during cutting. This photoresist is easily removed during the first acetone wash.
- The strainer containing chips should be removed from each beaker while the solution is stirred magnetically or swirled. This is because organics floating on aqueous solutions can be re-deposited onto the Si-chip surfaces if the chips are removed from a free standing wash solution.
- When finished the mirrored top surface of the clean Si-chips can be observed under the stereo microscope. They should appear as a dark field when observed under a stereo microscope.

There may be small amounts of fine silicon dust and some scratches or chips. Rewash any chips that appear otherwise.

- Si-chips may be flamed just prior to culturing cells on them to ensure sterility.
- Pre-cut wafers can also be purchased directly from Ted Pella, Inc. (<http://www.tedpella.com/>), product number 16008.