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Micro Automation Dicing Saw

Equipment Standard Operating Procedure

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1. **Purpose**
    1.1. The dicing saw is used to separate die from the wafer. A specified blade (dependant on substrate type) cuts the scribes lines in the x and y direction.

2. **Reference Documents**
    2.1. See website, http://mitghmr.spd.louisville.edu/lutz/resources/sops/sop53.html

3. **Equipment**
    3.1. Tweezers

4. **Materials**
    4.1. Blue Tape

5. **Protective Equipment**
    5.1. Eye Protection: safety glasses must be worn at all times.
    5.2. Hand Protection: vinyl gloves are not necessary but recommended to minimize organics onto the wafer.
    5.3. Ear Protection: earplugs are recommended since the spindle is loud when running.

6. **Engineering and/or Administrative Controls**
    6.1. The dicing saw is located in room 1332.
    6.2. The tool owner is Steve Sostrom, srs@eecs.umich.edu.
    6.3. The check off person is Ed Tang etang@umich.edu.
    6.4. Only authorized user may operate this piece of equipment.
    6.5. You must schedule the Dicing Saw and activate your reservation before using it.

7. **Procedure**

7.1. Know the layout of your wafer before cutting.

7.1.1. Know width of streets (scribe lines).

7.1.2. Thickness of cut.

7.1.3. Location of alignment marks.

7.2. Cleavage Plane

7.2.1. {100} wafers, natural cleavage planes exist perpendicular to the surface of the wafer in the directions parallel and perpendicular to the wafer flat.

7.2.2. {111} wafers, a vertical cleavage plane runs parallel to the wafer flat.

7.3. Types of Blades

7.3.1. The grit size of a blade is dependant on material to be cut.

7.3.1.1.The thinner the blade, the narrower the kerf (width of saw cut).

7.3.2. 7.14.2. Blade 00777-1045-008 is used to cut glass and hard materials.

7.3.2.1.7.14.2.1. The kerf is typically 230um (9.05mils).

7.3.3. Blade 42525 is only to cut silicon and softer materials.

7.3.3.1.The kerf is typically 110um (4.33mil).

7.3.4. Blade S1230-Q5HH-000 is used only to cut silicon and softer materials.

7.3.4.1.The kerf is typically 50um (2mil).

7.3.5. Always ensure there is a blade on the hub.

7.3.6. Edges of blades are very sharp and can easily cut through skin.

7.3.7. Blades are very delicate and can break easily.

7.3.7.1.Never touch the edge of a blade; this can cause the blade to deform.

7.4. Changing Blades

7.4.1. NEVER have the tool on when changing blades!

7.4.1.1.The spindle should not be moving.

7.4.2. New blades can be purchased from the LNF online store.

7.4.3. House Nitrogen must be on.

7.4.4. The vacuum valves must be on.

7.4.5. Remove the splash shields.

7.4.6. Unscrew the screws from the cover.

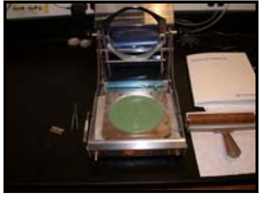
7.4.7. Unplug the water line (cooling hose) and remove the cover (blade shield).

7.4.8. Insert the blade removal tool with the allen wrench in the center of the spindle and the knurled sliver handle on the spindle nut.

7.4.9. Turn the knurled sliver handle counter-clockwise to remove the spindle nut.
7.4.10. Remove the spacer by sliding it off.
  7.4.10.1. Take note that the smooth side of the spacer faces you and notched side faces inside machine.
7.4.11. Use the vacuum gun to remove dicing saw blade.
  7.4.11.1. Vacuum switch is located under dicer, toggle to left to turn on vacuum.
7.4.12. Place plastic holder on top of blade then flip upside down and turn off vacuum to release blade.
  7.4.12.1. If blade sticks use the heat gun for ninety (90) seconds to heat around the blade.
7.4.13. Place new blade on hub in the opposite manner as removing.
  7.4.13.1. Writing on blade should face you.
  7.4.13.2. Blade should be inserted all the way into the axle.
7.4.14. Replace the spacer; smooth side faces you.
7.4.15. Place nut on finger tight.
7.4.16. Use the blade removal tool to tighten screws. Only make screws snug.
7.4.17. Replace the blade shield and cooling line.
7.4.18. Replace the splash shields.

7.5. Terminology
7.5.1. 1ST Index: street-to-street dimensions for first cut pass.
7.5.2. 2nd Index: street-to-street dimension for second cut pass.
7.5.3. Angle: theta axis turn between passes. 1 to 121 degrees.
7.5.4. DIA: diameter of wafer.
7.5.5. ENG/MET: mils or mm.
7.5.6. Height: amount of material left after cut.
7.5.7. Kerf: width of saw cut.
7.5.8. SCR/DICE: scribe, cut in both directions. Dice cut in one direction.
7.5.9. Speed: determines X-axis travel speed.
7.5.10. Thickness: wafer thickness plus film thickness (tape).
7.5.11. 0: progressive cuts, which means that the thickness of the item you are cutting is too thick to be cut in one pass. The saw will make a series of progressively deeper cuts on the same street (scribe line) before moving to the next street.

7.6. Mounting Wafer



7.6.1. Turn on the mounting machine using the switch located on the back center of tool.
7.6.2. Wait about fifteen (15) minutes for plate to heat to around 45°.

7.6.2.1.While waiting blow off any particles on the chuck (green pad).

7.6.3. Turn on the vacuum and nitrogen valves; both are located on the wall.

7.6.4. Place wafer face down on mounting machine (green pad). Have vacuum on.

7.6.5. Place saw frame around sample, aligning to the pins.

7.6.6. Slide blue tape across saw frame and wafer.

7.6.7. Use the roller to gently remove any bubbles from tape.

7.6.8. Lower the metal face plate and cut film around edges using a razor blade.

7.6.9. Using front toggle, flip on and off a few times for vacuum.

7.6.10. Raise the metal faceplate.

7.6.11. By using the front button to the right will help to release frame and wafer.

7.6.12. Turn off machine.

7.6.13. Note: tape is around 4 mils thick.

7.7. Dicer Setup

7.7.1. Log into book.

7.7.2. Check what blade was previously used; change if needed.

7.7.2.1.Check visually that it is the specified blade.

7.7.3. Turn tool on by rotating the red stop knob clockwise (right) till it pops out.

7.7.4. Turn on monitor.

7.7.5. Turn the nitrogen on.

7.7.6. Empty the vacuum trap if necessary. Please note that there is an o-ring seal that must be present on the clear water reservoir.

7.7.7. Turn the vacuum on

7.7.8. Press reset.

7.7.9. Set the spindle speed with the black knob on left.

7.7.9.1.Silicon: 8.4

7.7.9.2.Glass: 8.5

7.7.10. Press spindle to turn on motor wait for the beep.

7.8. Dicer Programming

7.8.1. It is wise to have all parameters calculated prior to set up, this way you may check for errors.

Saw command	Appropriate Value
Mode	60 for Progressive cut

ENG/MET	Mils or mm 1mm = 39.37 mils 1mil = 25.4um 100um ~ 3.937mils 1000mils = 1 inch = 25.4mm
SCR/DICE	Place red light in appropriate position
1st Index	Set stepping distance in Y direction, before rotation. Example 3mm
Height	What will be left after the cut? The depth of the cut equals the thickness of the specimen minus the programmed height parameter. **WARNING:** *Make sure there is enough blade to cut to your desired depth. If you try to cut too deeply, the blade hub will score your wafer. For a new blade, you may score your wafer if you cut more than 25mils deep on the 42525 blade, or more than 50 mils on the 777 blade. Don't forget that blade wear may reduce these clearances. Contact staff if you need help with this.*
Angle	Set rotation angle, usually 90
Round/Rectangular	Round: Diameter Set diameter of cut 4000mils or 1000mm For rectangular, press * key, enter specimen length dimension and press enter.
2nd Index	Set stepping distance in X direction Example 3mm
Thickness	Set thickness of wafer and film (blue tape) Silicon wafer: 24mils for 4 inch (500-550um) Glass wafer: 33.5 mils Blue Tape: 3.5 to 4 mils ***WARNING:*** *Know what your maximum thickness is, so that you do NOT cut into the vacuum chuck! Use the micrometer to get an accurate measurement.*
Speed	Cutting Speed Silicon: 100 Glass: 50
0	Set max depth per pass

	Silicon: 8 mils (max 10) Glass: 4 mils (max 6)

7.8.1.1. Each command button is located on the left side of the saw's front panel.
7.8.1.2. After pressing a command, press clear, enter appropriate value, press enter and go to next command.
7.8.2. Press read and scan through all programmed parameters to check for typos.
7.8.3. Press read again to take out of read mode.
7.9. Zero Chuck

7.9.1. Place gauge plate (stainless steel plate) under the camera so that both lights can been seen on the plate.
7.9.2. Press chuck to lock. Double check that there is vacuum.
7.9.3. Press chuck zero.
7.9.4. After the beep, press chuck to unlock.
7.9.5. Remove the gauge plate.
7.10. Test Cut
7.10.1. This step is performed to align cameras.
7.10.2. Place the silicon test sample on plate.
7.10.2.1. Slide the V-groove of the mounting frame into the mounting pin with the second pin butting against the flat of the frame.
7.10.3. Press chuck to lock. Check vacuum.
7.10.4. Press index.
7.10.5. Use the right/left/back/forward buttons to move wafer to an area for a test cut.
7.10.6. You may also use the following buttons to move the camera:

Button	**Camera Movement**
Align	Move camera and blade in small amounts
Index	Move camera and blade in larger increments. The increments are set in the programming of 1st and 2nd index
Fast	Makes the next button pushed to operate in fast mode.

7.10.6.1. When using the FWD button the direction of the screen and blade are backwards.
7.10.6.2. Switching from index to align mode the saw automatically moves to the right as a reference.
7.10.6.3. If your index cut goes off the diameter of the wafer, the saw will rotate and do another index cut.
7.10.7. Press the H20 button under the dicer in front left corner to wet the sample.

- 7.10.8. Press single cut, to make the test cut.
- 7.10.9. Use the nitrogen gun to blow the excess water off the wafer.
- 7.10.10. If the test cut is off the screen, turn the knob behind the camera to bring the cut to the center of the screen.
  - 7.10.10.1. The camera settings are different for silicon and for glass, so if the blade was changed then the camera will need to be moved.
  - 7.10.10.2. Adjust the kerf.
- 7.10.11. Run another test cut. Check if everything lines up.
- 7.10.12. Remove sample by unlocking.

7.11. Sample Alignment

- 7.11.1. Place sample on chuck in the same manner as the test sample.
- 7.11.2. Press lock and check vacuum.
- 7.11.3. With the 1st and 2nd index values entered, align camera to a line you wish to cut using the left and right buttons. Ensure the theta is correct.
- 7.11.4. Adjust the theta with the CW and CCW.
- 7.11.5. Press index to set the index mode.
- 7.11.6. Press back and forward to ensure Index values are properly set. Re-program if necessary.
  - 7.11.6.1. You also want to check for drift.
- 7.11.7. Program cut count and stops count for desired number of cuts.
  - 7.11.7.1. Use a small number of cuts to ensure drift will not cause a problem.
- 7.11.8. In index mode, press auto cut. The blade will step back one index and then make each cut.
- 7.11.9. If auto cut is used in align mode, the saw will move to one side of the wafer before making the first cut.
  - 7.11.9.1. Since it is harder to predict exactly where the cut will begin, this option should be avoided.
- 7.11.10. To rotate the wafer 90°, while in index mode press CCW.
  - 7.11.10.1. Remember to change your cut count.

7.12. Remove Wafer and Clean Up

- 7.12.1. Press fast then left to move the sample all the way to the left.
- 7.12.2. Press chuck to unlock sample.
- 7.12.3. Remove frame and blow dry with nitrogen.
- 7.12.4. Dry off chuck with towels.
- 7.12.5. Remove shields and wipe dry saw and shields.
- 7.12.6. Place a towel between water jets and chuck.
- 7.12.7. Press red stop button to turn of tool.
- 7.12.8. Turn off monitor.
- 7.12.9. Close the nitrogen and vacuum valves.
- 7.12.10. Empty the vacuum trap. Please note that there is an o-ring seal that must be present on the clear water reservoir.
- 7.12.11. Ensure area is cleaner than when you found it.
- 7.12.12. Complete logbook.

8. **Waste Products**
    8.1. Broken wafers are to be discarded in the glass trash located in the main clean room.

    - **Report all accidents (injuries, spills, fires) to the SSEL On Call or other SSEL staff. For emergencies during non-business hours, call the SSEL Emergency Response Team at (734) 764-4127 or Department of Public Safety at (734) 763-1131.**