



# FlipScribe® Operations Manual

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## Overview of the FlipScribe®:

The FlipScribe® enables cleaving through frontside targets with a scribe made on the backside of the substrate. This methodology is required for cleaving bonded substrates and used for crystalline and amorphous samples with sensitive devices on the frontside as contamination from the scribing process is eliminated. Coupling the FlipScribe® with an optical microscope improves cleaving accuracy and repeatability. Use the point of the diamond scribe to cleave the sample using LatticeGear's "flipscribe and cleave" process making it a very quick tool for cleanly downsizing large samples. Alternately, cleave the sample using cleaving pliers such as LatticeGear's Cleanbreak or Small sample cleaving pliers.

The main components of the FlipScribe® are described below and shown in Figure 1:

1. Sample platform using a fence-guide design. Orthogonal vertical guide and horizontal sample slide fence guides are used for alignment and scribing of the sample.
2. A ruler is embedded in the sample surface of the sample plate for quick sample measurement and sizing.
3. Scribe stop allows scribe length to be defined.
4. Diamond scriber\* with height and angle adjustment (see also Figure 2).

\*The diamond scriber is a consumable and provided in a user exchangeable cartridge.

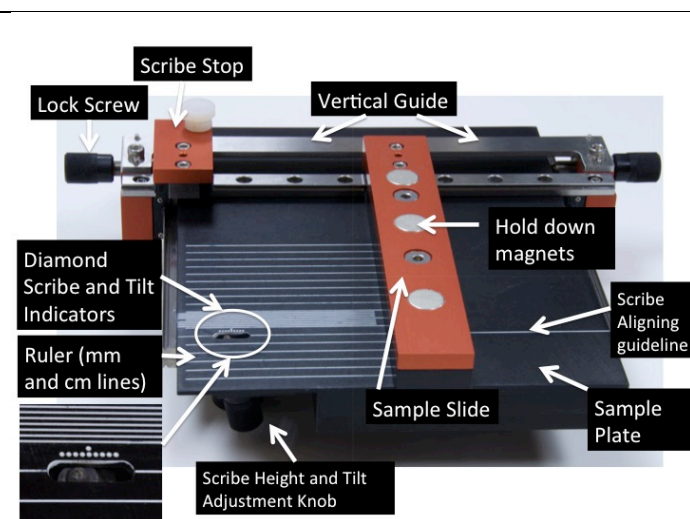


Figure 1 Flipscribe™ Overview

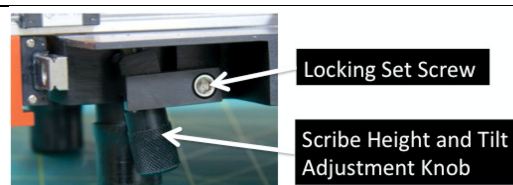


Figure 2 Locking Set Screw and Scriber Height and Tilt Adjustment Knob.



Figure 3 User replaceable diamond scriber and adjustment knob.

## Using the FlipScribe®

The following description describes positioning, scribing and cleaving the sample.

### Use of the FlipScribe with an optical microscope

1. Although not required, it is very useful to use the Flipscribe with an optical microscope (See Figure 4), especially when setting the height of the diamond scriber (If you are not using a microscope, go to Step 8 and review the tip on how to mark the scriber tip prior to setting the tip position).
2. Set the Flipscribe such that the diamond scriber is centered in the field of view at the lowest magnification. It can be positioned as shown or rotated counter clockwise 90 degrees, whichever is most comfortable for the user.

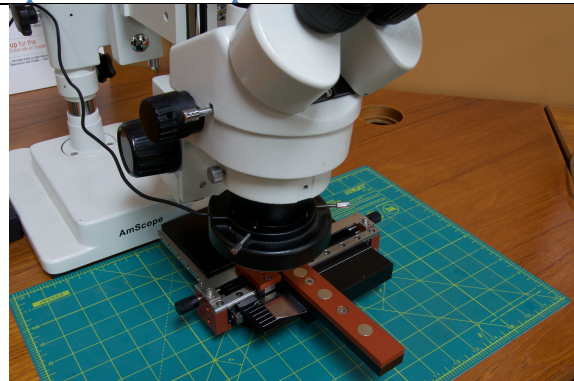


Figure 4 FlipScribe positioned for viewing with the stereoscope.

### Set the tilt and height of the diamond scribe (if not previously set)

3. The diamond scribe tilt and height should be set while viewing it under the stereoscope. This makes it simple to set the position relative to the scribe's facets.
4. First set the tilt. Tilt is adjusted by tilting the scribe with the tilt adjustment knob (Figure 6) using the tilt alignment indicators as reference points (see Figure 5). The vertical position has two dots. For most samples set the tilt to -1 to -3 dots from vertical.
5. Once tilt is set, tighten the locking set screw. Tighten only enough to prevent it from moving by itself. This enables tilt to be adjusted without adjusting the set screw.

Note: The default position works well for most samples. Fine tuning the height and tilt for samples such as glass and off crystal plane samples are important to get the best quality and success rates.

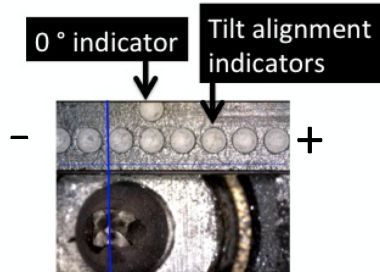


Figure 5 Set the tilt of the diamond scribe. A tilt of -1 to -2 is shown.

6. Set the height. Turn the knurled scribe height adjustment knob to adjust the scribe height. For instructions on height adjustment see the section on adjustments (Steps 26-32).
7. Make sure that the final position of the scribe is as shown- aligned along the sharp edge of the facets (drawn blue line). This will create a fine, well defined scribe.

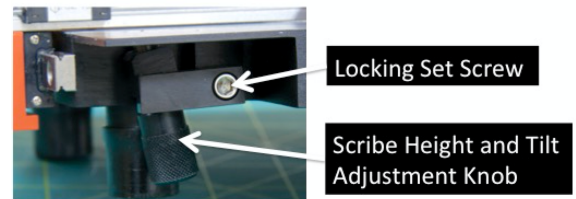


Figure 6 Set the height of the diamond scribe

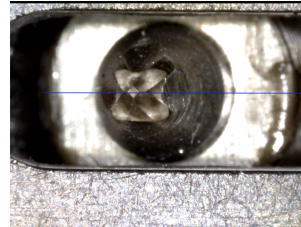


Figure 7 The diamond scribe should be oriented as shown

8. Tip. If the FlipScribe is being used without a stereoscope or other magnifying lens, it is useful to mark the sharp edges of the facets with a permanent ink pen. This will help to align the facets without a microscope.

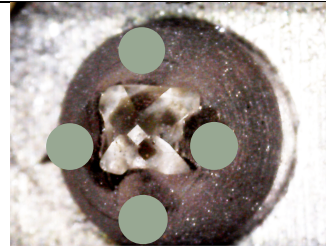


Figure 8 View of scriber tip and position of facet marks

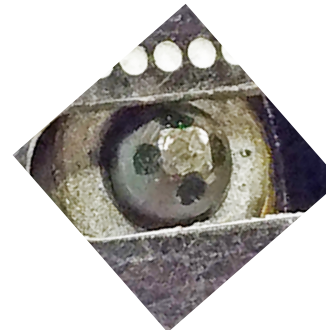


Figure 9 View of scriber tip with actual facet marks.

## Positioning the sample

9. Loosen the vertical position lock screw and the adjustable scribe stop screw.
10. Place the sample with one edge against the vertical guide and the other against the sample slide.

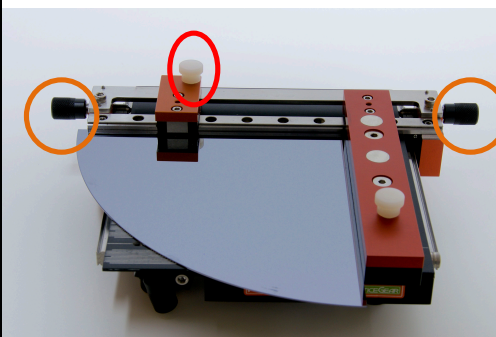


Figure 10. Wafer sample aligned against the vertical guide and sample slide.

11. Position the sample for scribing by pushing the sample with the slides such that the area of interest is touching the diamond scribe tip (See Figure 11- region circled in orange).
12. The long white line embedded in the sample plate is in-line with the tip of the diamond scribe. It can be used as an aid to position the target.
13. Move the vertical guide until the target is aligned with the tip of the scribe and the long white line.
14. Once the target is positioned, tighten the vertical guide locking screws (Figure 10-regions circled in orange)

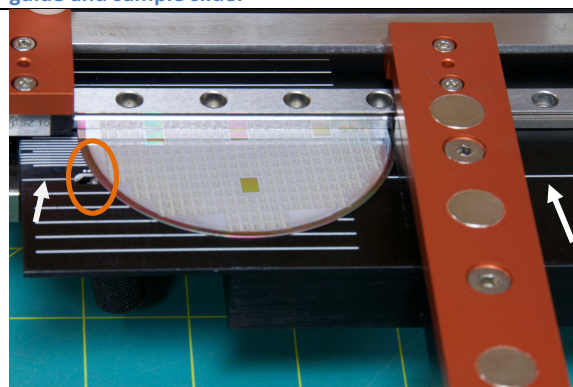


Figure 11. Sample positioned for cleaving.

## Setting the scribe length and scribing the sample

15. Setting the Scribe length.  
Use the adjustable scribe stop to set the length of the scribe.
  - a. For a short scribe lock the scribe stop several millimeters from the horizontal sample slide.
  - b. For a long scribe move the slide stop away from the horizontal sample slide.
  - c. For a scribe that extends across the length of the sample move the scribe stop as far away from the horizontal sample slide as possible prior to scribing.

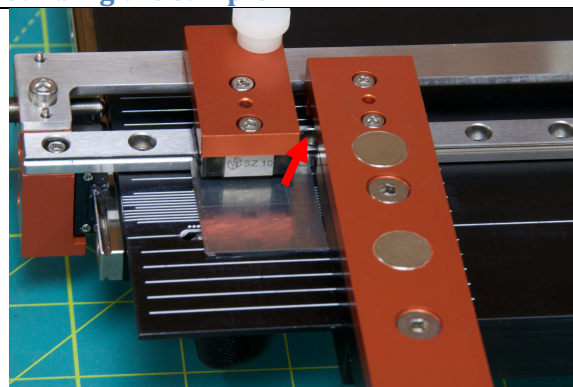


Figure 12 Setting the scribe stop for a short scribe.



16. Scribe the sample.

- a. Scribe the sample by pushing the sample over the diamond scribe with the horizontal sample slide. Use your fingers to hold the sample down during scribing to prevent the front edge from rising when scribing.

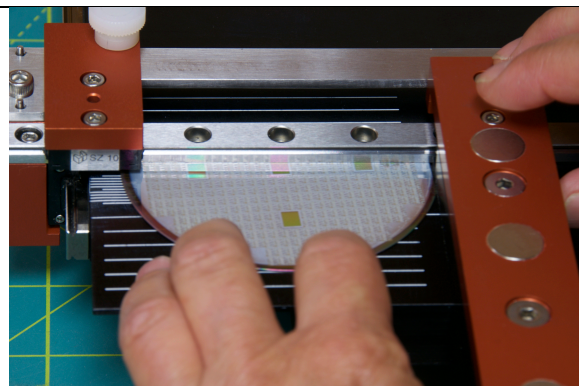


Figure 13 Scribing the sample

- b. Or use the optional sample holders See **Appendix 1**

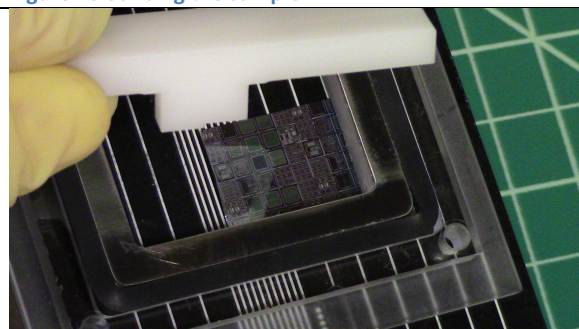


Figure 14 Placing the magnetic holddown to secure the sample.

## Cleaving the sample (Each example follows a 3 pt cleave approach)

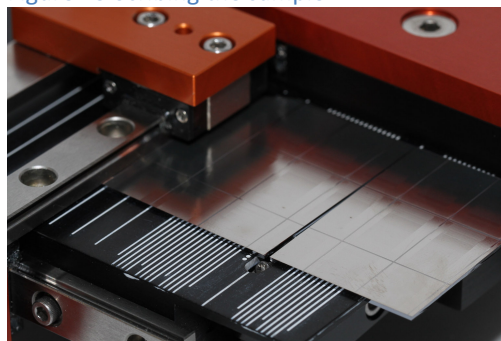
There are many ways to cleave samples after scribing. Below are a few examples.

17. **Cleaving by snapping.** Grab the sample edge with the scribe facing up with both hands, typically using the thumb and middle fingers approximately 10 mm from the scribe and bend the sample away from the scribe. It will cleave along the direction of the scribe.
18. **Cleave using the CleanBreak (CWBR-100) or Small sample cleaving pliers (GC-SS-100).** The plier jaws are typically positioned on the edge of the sample with scribe facing towards the aligning mark on the pliers.
19. **Cleave the sample over a pin.** Lay the sample with the scribe facing up over a paper clip, needle, fine wire or pin. Push with fingers symmetrically on either side of the scribe until the sample cleaves.
20. **Cleave using the FlipScribe.** Use the point of the FlipScribe scriber to cleave the sample. Push with fingers symmetrically on either side of the scribe until the sample cleaves. Using this method when performed under a stereoscope allows the user to view the sample while it is cleaving, thus providing better control of the positioning and cleaving pressure.

## Applications Notes

21. **Scribing crystalline materials.** The best results for crystalline materials are obtained when using a short scribe. This results in a cleave along the length of the sample driven by the crystal plane. It will produce the highest quality cleaved edge. In some cases, if the leading edge of the sample is uneven or curved, a long scribe is required to initiate the cleave.

Figure 15 Scribing the sample

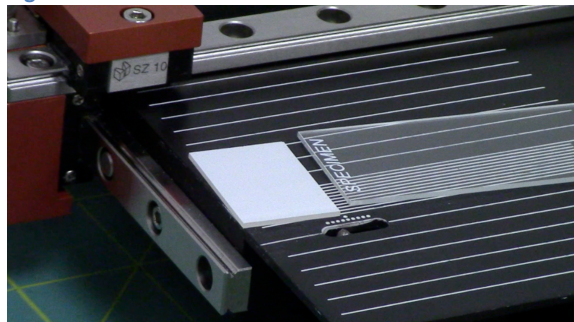


22. **Scribing amorphous substrates.** Amorphous and polycrystalline materials require the scribe to extend across the entire sample. In some cases, a short scribe can be used to initiate the sample fracture, this produces a very clean edge desirable for SEM. The fracture is typically not straight but this is a good method if accuracy is not required.
23. **Note that for glass, a deep scribe is not required.** Table 1 gives a summary of scribing parameters for different materials and applications.

Figure 16 Glass Slide example



Figure 17



## Adjustments and Maintenance: Scriber height and angle adjustment

24. Default settings. The tool ships with the default settings as shown in Figure 18. This setting can be used for crystalline materials.
25. For very hard materials or those that scribing is counter to a crystal plane the height and angle can be increased to get a deeper scribe. Note that this is not always necessary. It is recommended that a recipe be developed prior to scribing a one-of-a-kind sample.

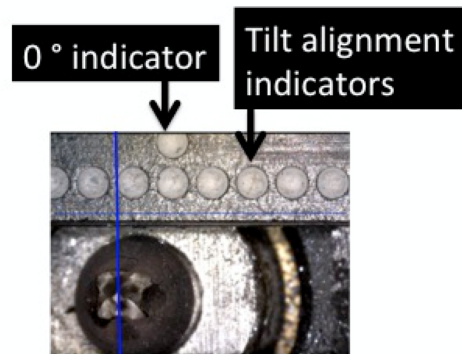


Figure 18 Diamond scriber tip and tilt indicators

## Adjustments and Maintenance: Exchanging the diamond scriber and setting the tilt and height.

26. The FlipScribe scriber is mounted in a cartridge. It is removed by first loosening the scribe holder adjustment locking set screw (Figure 19). Tilt the FlipScribe up and then pull the housing and scriber cartridge up, away from the tool to remove it.
27. After removing the old scriber assembly (Figure 21), drop in the new cartridge and housing (Figure 22).
28. Thread the scriber into the housing and gently tighten the locking set screw as shown in Figure 19.

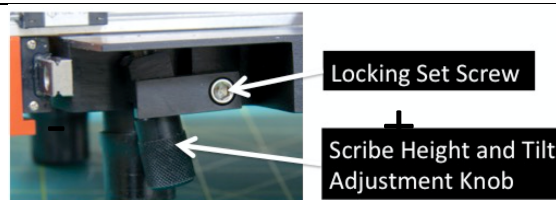


Figure 19 Diamond scriber cartridge and locking mechanism



Figure 20 Diamond scriber housing



Figure 21 Cartridge and housing after removal



Figure 22 FlipScribe prior to installation of new cartridge.

29. Set the default angle using the white tilt alignment indicators as a guide (Figure 23).
30. Set the default height. (Stereoscope recommended)
  - a. First turn the scribe knob clockwise until the scribe tip is below the work surface.
  - b. Set a flat sample on the tool in the proximity of the diamond scribe.
  - c. While moving the diamond scribe up (counter-clockwise), slide the sample over the scribe to determine when the tip is level with the tool surface (Figure 24).
  - d. Remove the sample from the tool.

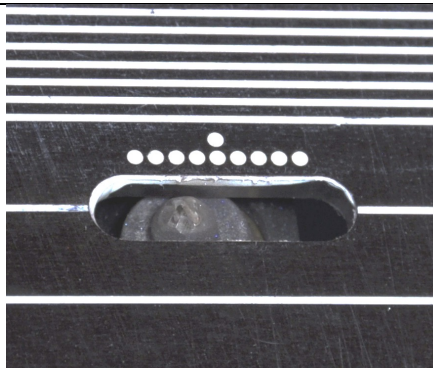


Figure 23 Set the tilt by adjusting the tilt adjustment knob

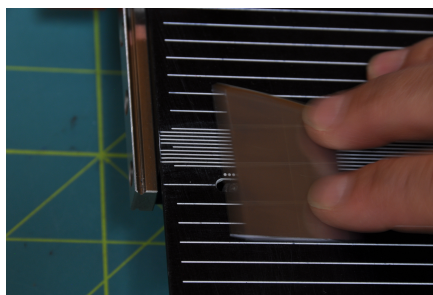


Figure 24 Slide the sample over the scribe until it makes contact.

31. While observing the tip with a stereoscope or magnifying lamp, turn the height adjuster and align the nearest facet edge so it is horizontal. It will be aligned with the long line embedded on the tool work surface (see Figure 23).
32. Turn the height adjuster (counter clockwise) increasing the diamond scribe height a **quarter** turn and aligning to the nearest facet. The facet will still be horizontal as shown in Figure 25.

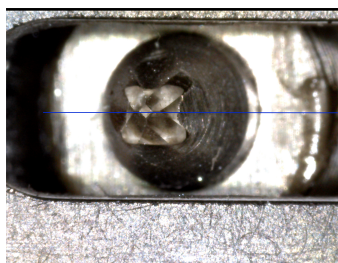


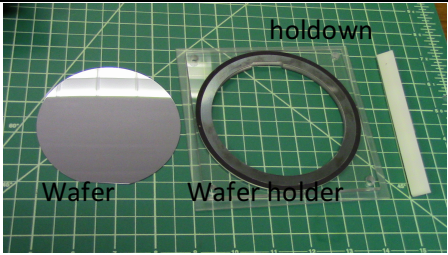
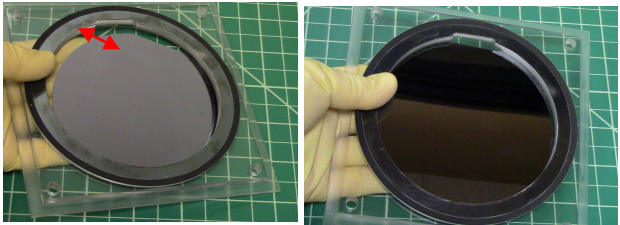
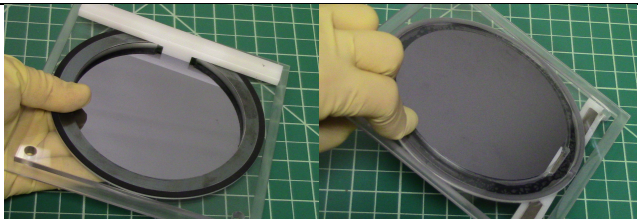
Figure 25 Scribe tip aligned to a facet edge and the long line on the tool work surface.

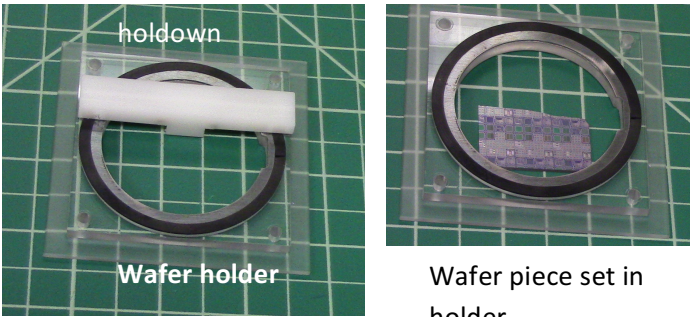
Table 1 Scribe guidelines

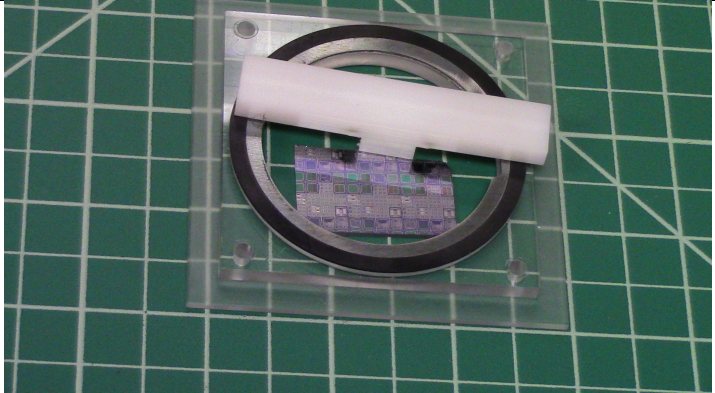
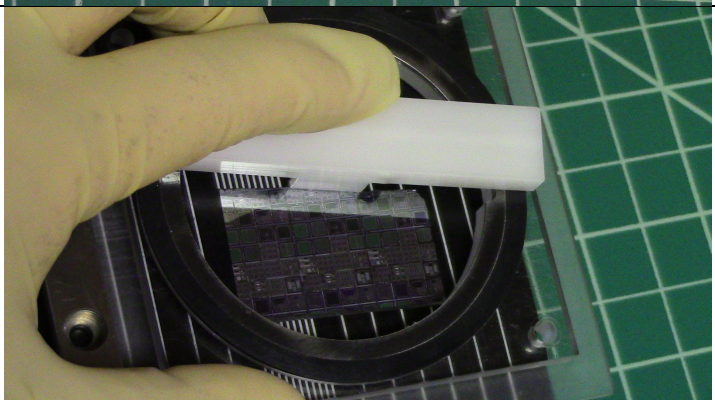
Material	Scribe type	Scribe depth	Length	Tilt	Height
Silicon/GaAs (100)	Short	Hairline	<1.5" (38mm)	-2 dots	Standard
Glass	Full length	Hairline	Any	-2 dots	Standard



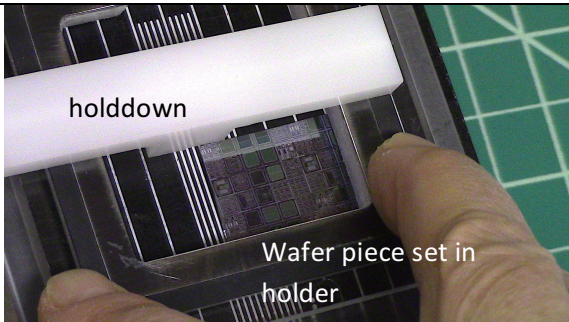
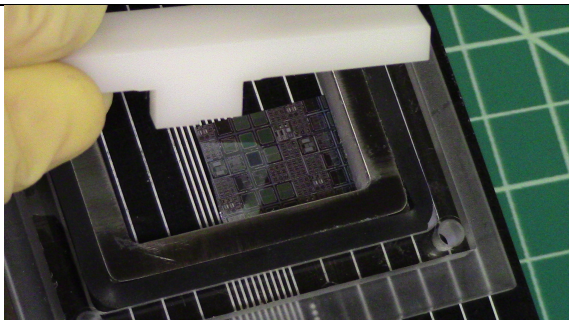
## Appendix 1. Using FlipScribe Holders

Loading a sample in the wafer holder (2", 3" or 4")	
<ol style="list-style-type: none"> <li>To load a sample in the wafer holder you will need: <ol style="list-style-type: none"> <li>Wafer holder</li> <li>White Wafer holddown</li> <li>Wafer sample</li> </ol> </li> </ol>	
<ol style="list-style-type: none"> <li>Pick up the wafer and load it into the holder from the back side of the holder</li> <li>Orient the wafer flat so it is parallel with the detent in the wafer holder.</li> </ol>	
<ol style="list-style-type: none"> <li>Place the holddown in the detent and press it up against the holder.</li> </ol>	 <p>Frontside of the holder      Backside of the holder</p>

Loading a wafer piece in a wafer holder (2", 3" or 4")	
<ol style="list-style-type: none"> <li>To load a sample in the wafer holder you will need: <ol style="list-style-type: none"> <li>Wafer holder</li> <li>Wafer holddown</li> <li>Wafer piece</li> </ol> </li> </ol>	 <p>Wafer holder      Wafer piece set in holder</p>

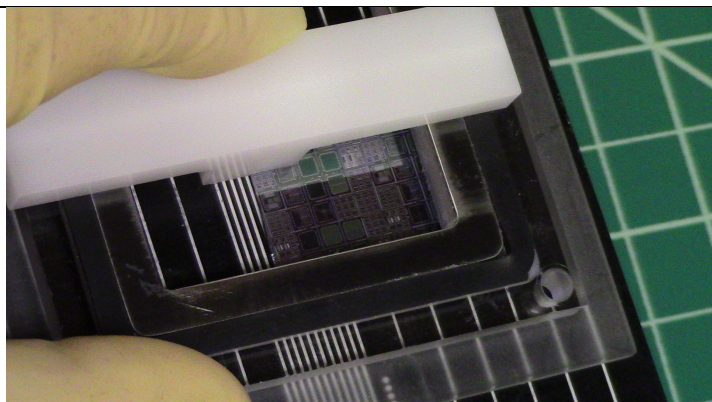
<ol style="list-style-type: none"> <li>The holddown can be positioned in any rotation to hold the sample in place.</li> </ol>	
<ol style="list-style-type: none"> <li>Place the holder with the sample on the FlipScribe.</li> <li>Use the vertical guide to position the sample.</li> <li>Scribe the sample by sliding it against the vertical guide</li> </ol>	

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Loading a wafer piece in the square holder (1.5")	
<ol style="list-style-type: none"> <li>To load a sample in the wafer holder you will need:             <ol style="list-style-type: none"> <li>Square holder</li> <li>Wafer holddown</li> <li>Wafer piece</li> </ol> </li> </ol>	
<ol style="list-style-type: none"> <li>If the sample has good edges, close to 90 degree corners, slide the notch in the holddown over the corner of the sample. This will assure it doesn't move while scribing</li> <li>If the sample has poor edges, use the holddown as shown in step 1.</li> </ol>	



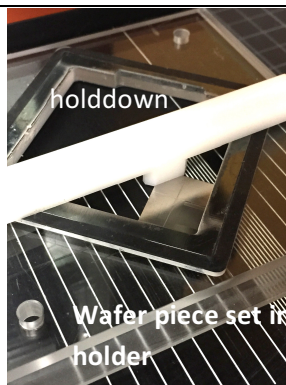
4. Place the holder and sample on the FlipScribe.
5. Position the area of interest for scribing and lock the guides.
6. Slide the holder against the guide to scribe the sample.



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## Loading a wafer piece in the 45 degree holder

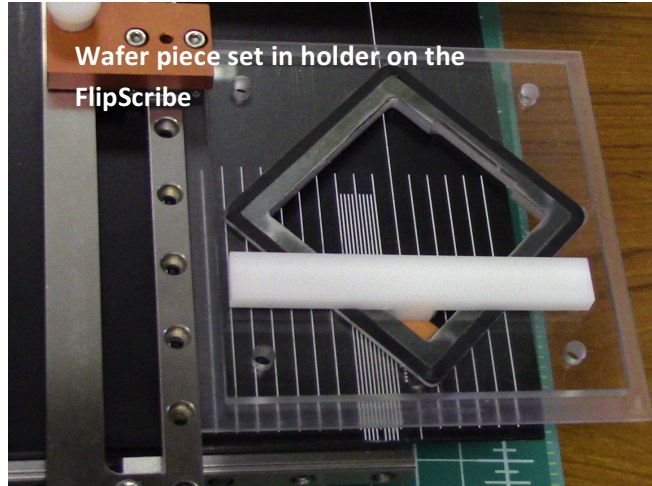
1. To load a sample in the wafer holder you will need:
  - a. 45 degree holder
  - b. Holddown
  - c. Wafer piece



2. Correct positioning of the holddown over the corner of the sample.



3. 45 degree holder and sample on the FlipScribe



4. Scribe the sample by sliding it over the diamond scribe
5. Use both hands to assure that the holder slides against the rail and the sample does not move during scribing.





