

Application Note

Wet Etching in AnisE

Application Note: Wet Etching in AnisE
Version 8.5/PC

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Patent Number 6,116,766: Fabrication Based Computer Aided Design System Using Virtual Fabrication Techniques

Patent Number 6,157,900: Knowledge Based System and Method for Determining Material Properties from Fabrication and Operating Parameters

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I Accelerometer

To open AnisE,

Click *Start... Programs... AnisE*

The AnisE window will appear as shown below.

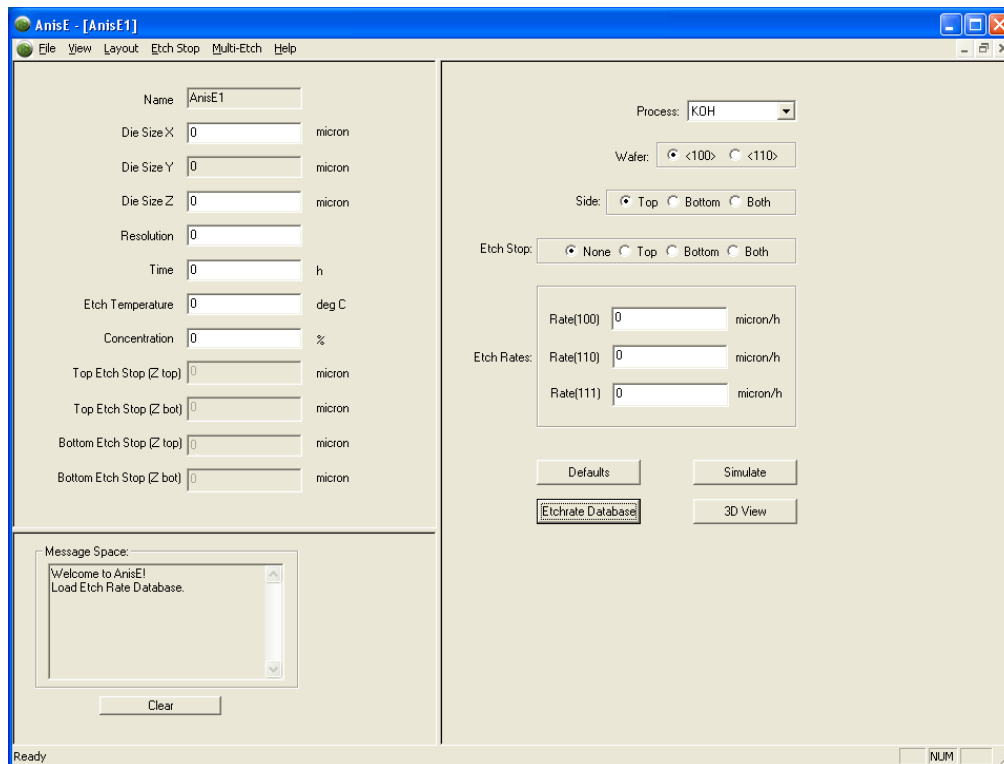


Figure 1: AnisE Window

In the top left portion of the window, you can set the size of the silicon wafer, the simulation resolution (see the AnisE Help under the Help menu for more information), the etch time, etch temperature, and etchant concentration. In the right portion of the window, you can select the etchant, the wafer orientation, the side of the wafer you will be etching, and the etch stop. The *Defaults* button will input default values into the fields on the left side of the window. The *Etchrate Database* button will input etch rates from IntelliSense's etch rate database based on the provided etch temperature and concentration. It is also possible to input your own etch rates into the etch rate fields.

To open the simulation file that has already been set up,

Click *File... Open*

Open *Proofmass.sim* in the \Intellisuite\Training\AnisE\Accelerometer folder. The simulation settings are shown in the figure below.

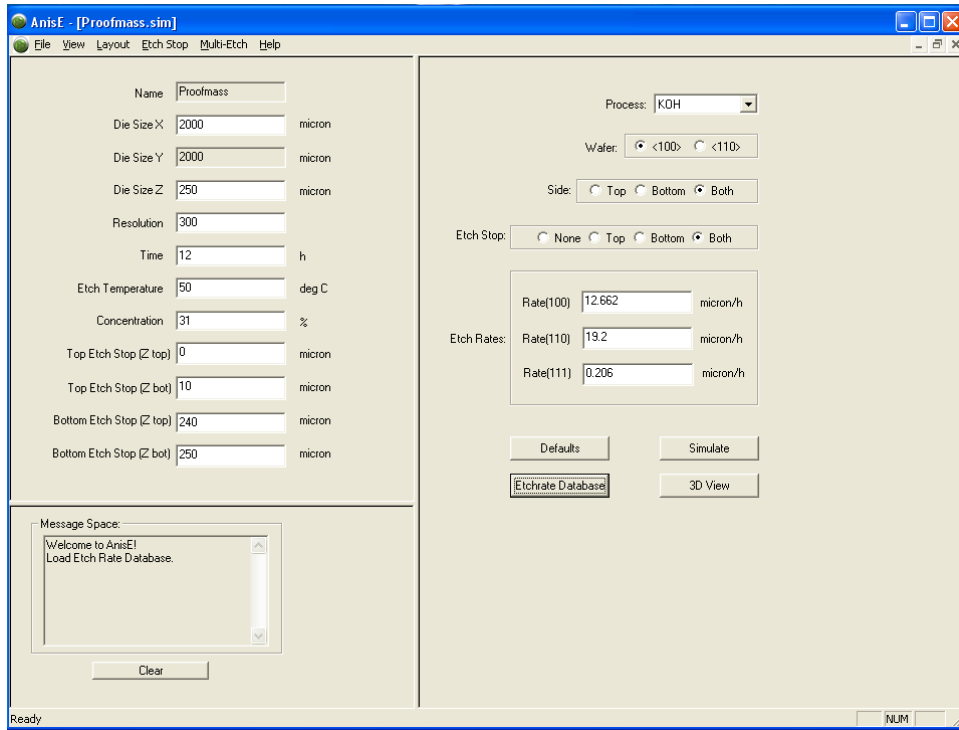


Figure 2: Accelerometer Simulation Settings

You can see that we will be etching both sides of the wafer with a 10 mm etch stop on the top and bottom.

The mask layouts for this simulation have already been loaded. To view the top mask,

Click *Layout...Create/Edit...Top Mask*

This will open the mask in IntelliMask, IntelliSense's mask layout editor.

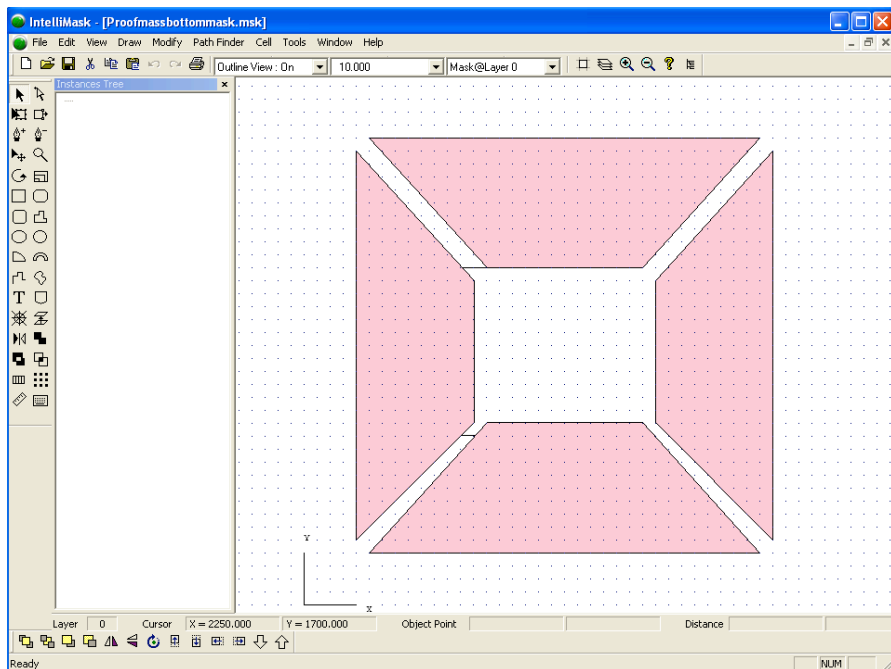


Figure 3: Top Mask in IntelliMask

This mask is also defined as the bottom mask; you can view it by selecting *Layout...Create/Edit...Bottom Mask*.

When starting a simulation from scratch, you'll need to choose the *Layout...Import* function and select your desired mask file. The *Layout...Mask Option* feature allows you to choose whether to protect inside or outside the mask. In this case *Protect Inside* is selected.

Select *Create/Edit* in the *Etch Stop* menu to view the top and bottom etch stop masks. The mask used for both etch stops is shown below.

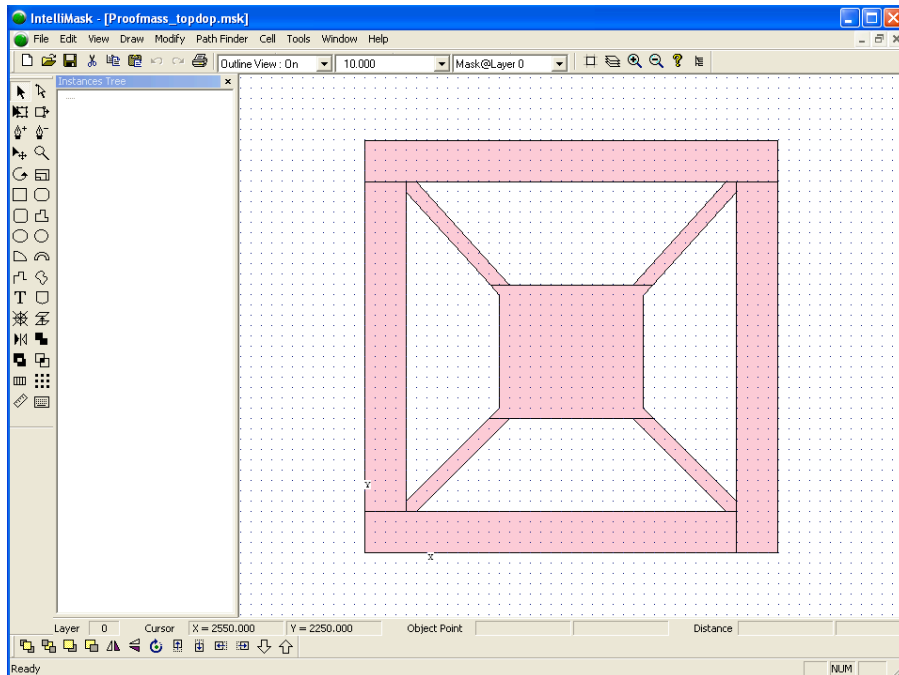


Figure 4: Top Etch Stop

After the masks and simulation settings are defined, we are ready to run the simulation. Click the *Simulate* button. During the simulation, a window will appear showing the simulation progress.

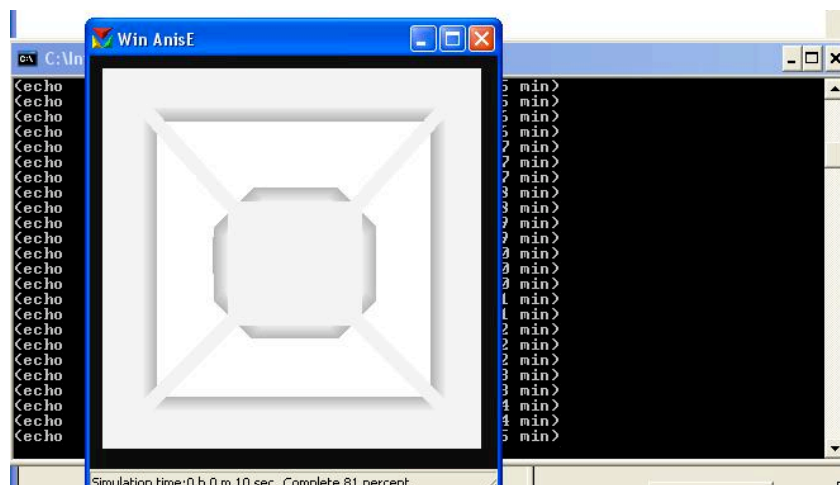


Figure 5: Simulation Progress Window

This window will disappear when the simulation is complete. To view the results, click the *3D View* button. A 3D representation of the structure will appear in a new window as shown below.

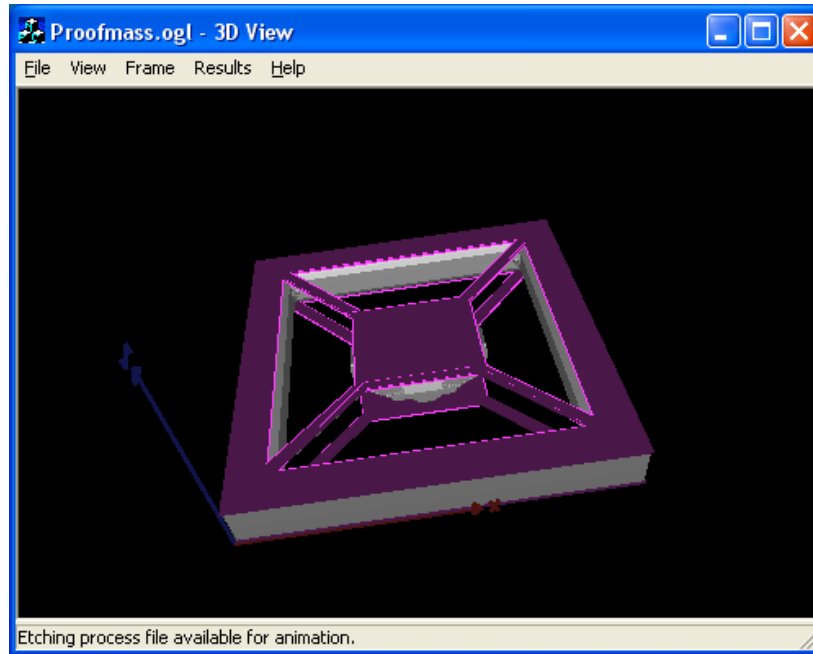


Figure 6: Etched Structure

You can rotate the structure with the mouse and zoom in and out using SHIFT+Arrow Keys. Under the *File* menu, you can open a *.ogl file from another simulation or save the image as a JPEG. The *View* menu allows you to set the view settings and choose whether the etch stop and mask outlines are visible. In the *Frame* menu, you can view the simulation frame-by-frame and view or save an animation of the simulation. You can measure the distance between two points using the *Measure* option in the *Results* menu. The distance will show up in the message bar at the bottom of the 3D View window.

2 Corner Compensation

To view a corner compensation example, select the “Corner_Comp.sim” file in the Intellisuite\Training\AnisE\Corner_Compensation folder.

The simulation is set up as shown below.

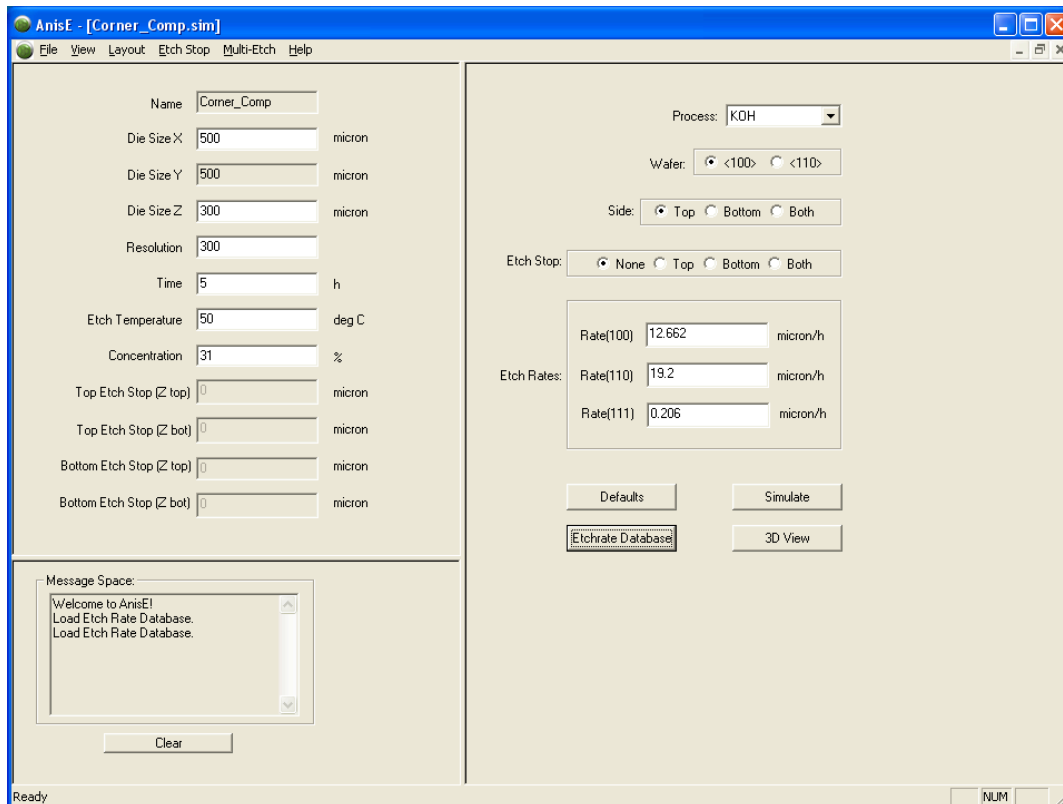


Figure 7: Corner Compensation Settings

Click *Layout...Create/Edit...Top Mask* to view the mask layout in IntelliMask.

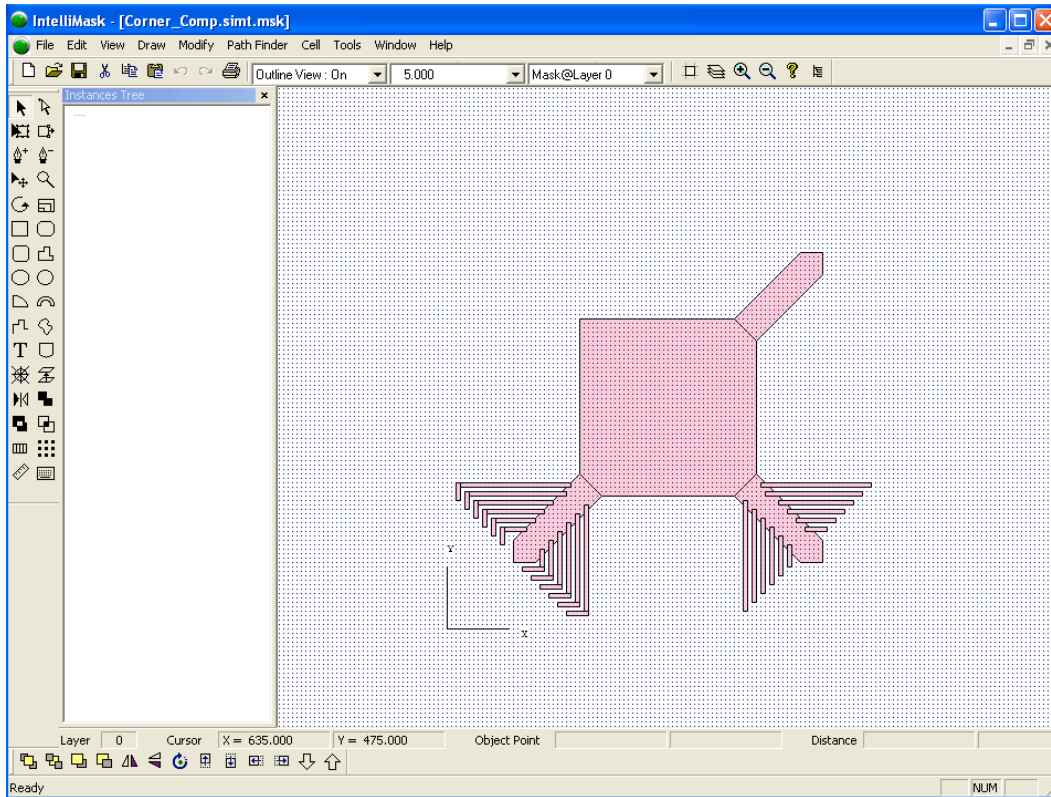


Figure 8: Corner Compensation Mask

Click the *Simulate* button to run the simulation, and click the *3D View* button when the simulation is finished. The structure will appear as shown below.

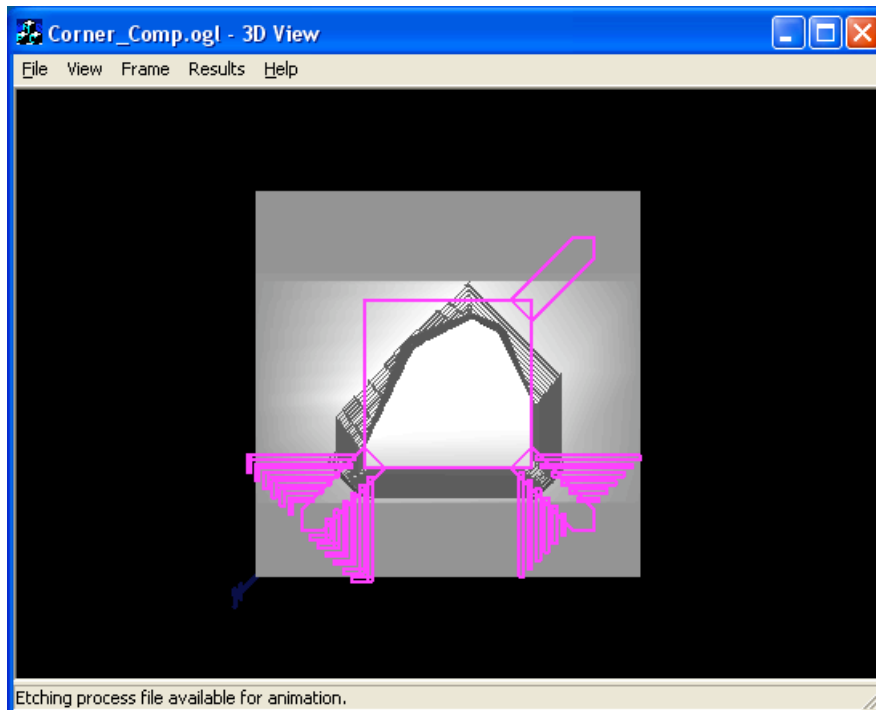


Figure 9: Etched Structure

Click *View...Mask Outline* to get a better view of how each corner is affected by the shape of the mask.

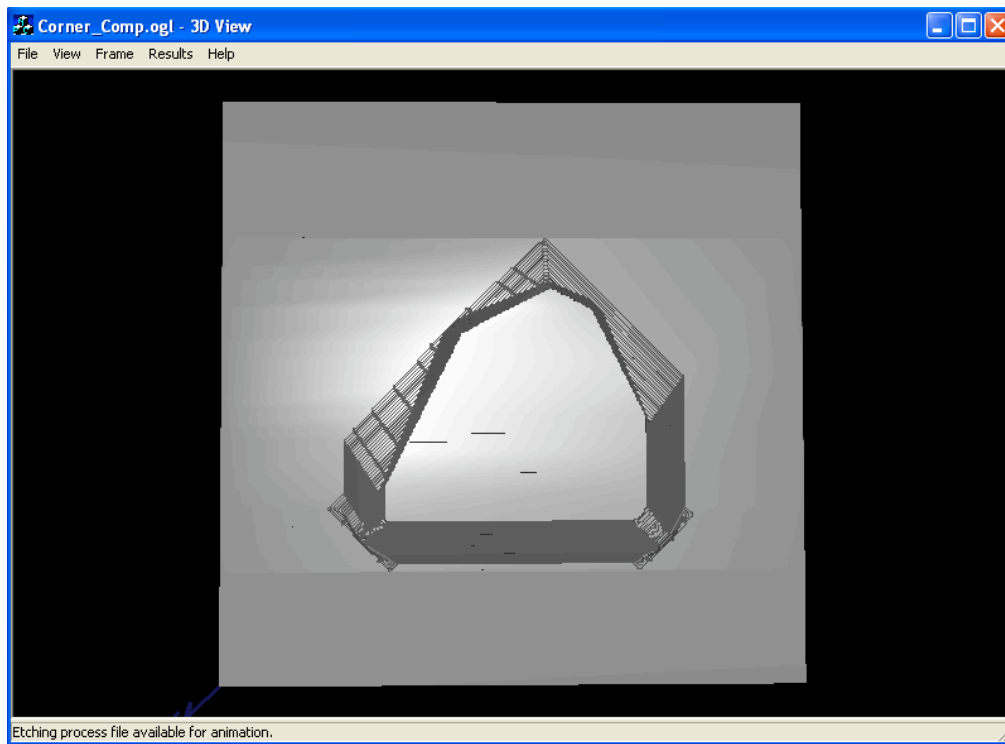


Figure 10: Structure without Mask Outline

3 RIE + Wet Etching

This example will show how to use the Multi-Etch feature in AnisE.

Set up the simulation as shown in the figure below.

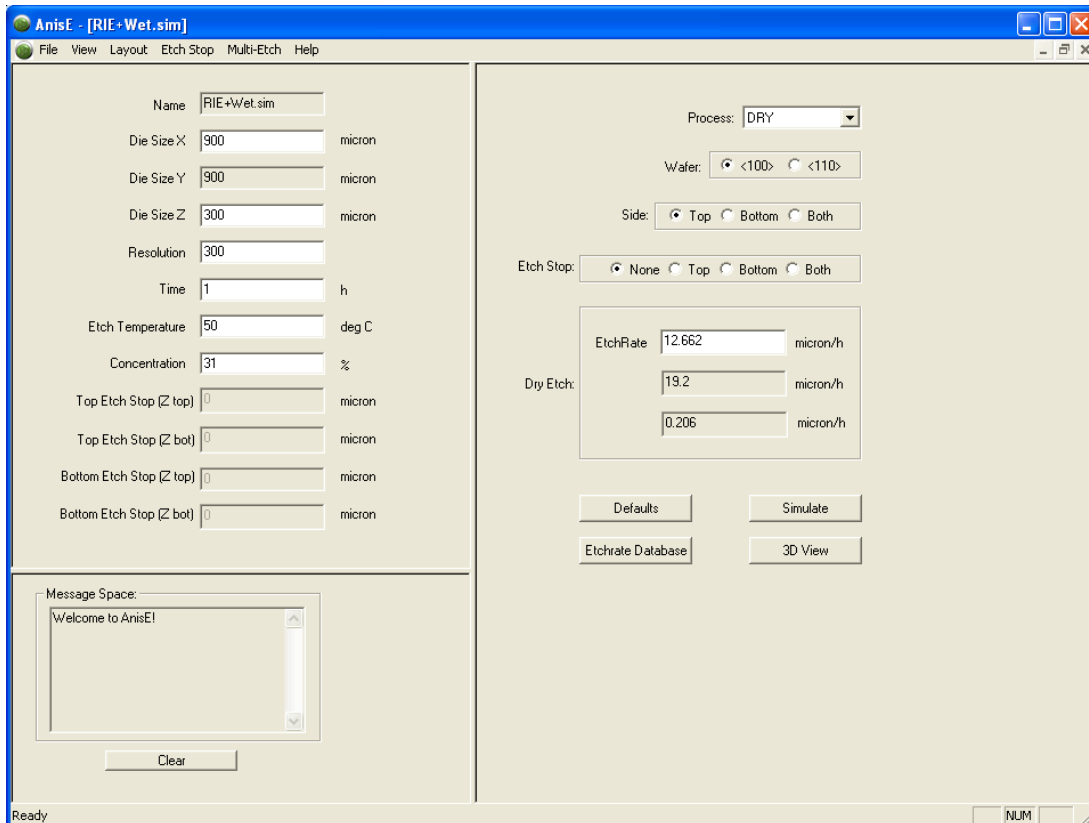


Figure 11: Dry Etch Settings

Click *Layout...Import...Top Mask*

Select *RIE+Wet.simt.msk* in the IntelliSuite\Training\ AnisE\RIE+Wet folder.

Click *Simulate* to run the simulation. After the simulation is complete, click *3D View* to view the results. The etched structure will appear as in the figure below.

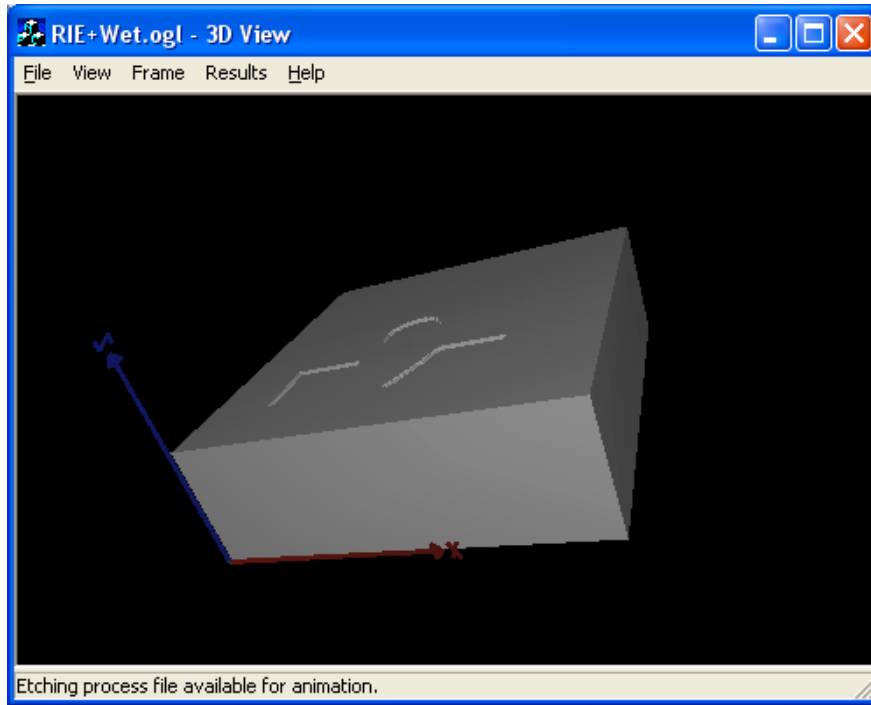


Figure 12: Structure After Dry Etch

After examining the structure, close the 3D View window. In the main Anise window, change the *Process* to KOH and the *Time* to 6 h. Select *Load Previous* in the *Multi-Etch* menu. This means that the wet etching will be done on the structure we have just etched instead of a blank die.

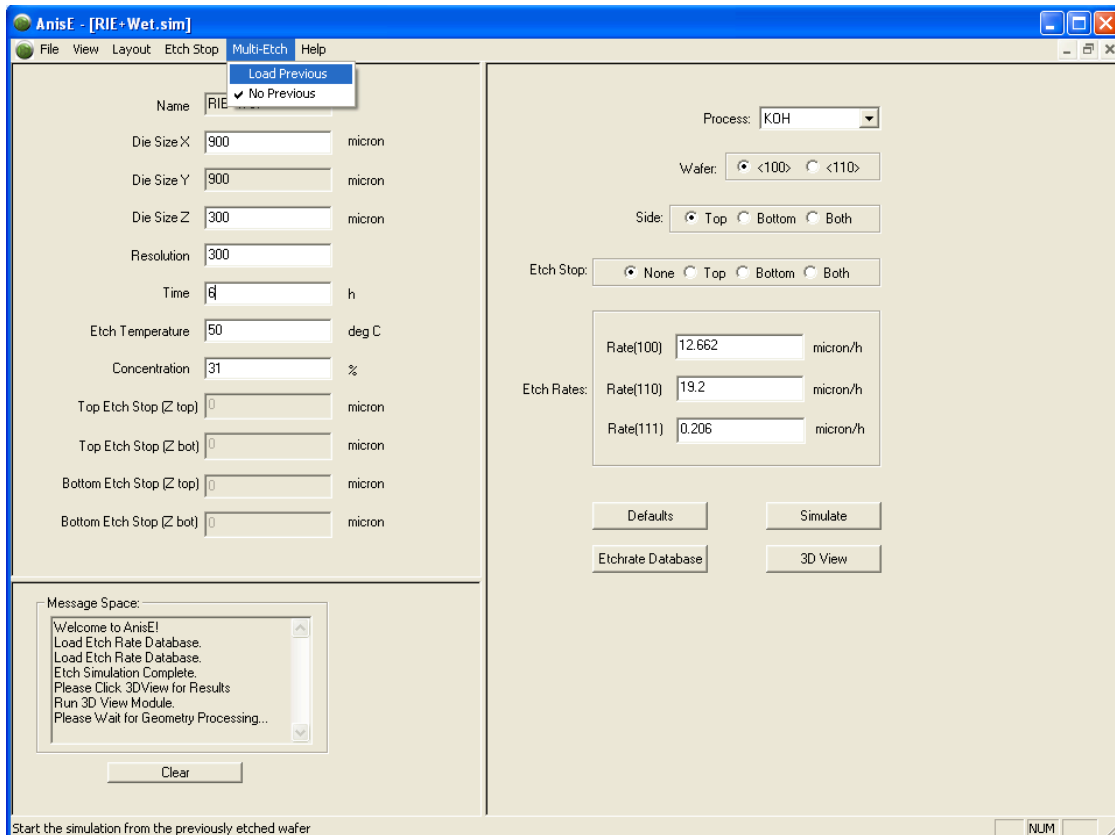


Figure 13: Wet Etch Settings

Click *Simulate* to run the simulation. After the simulation is complete, click *3D View*. The results will appear as shown below.

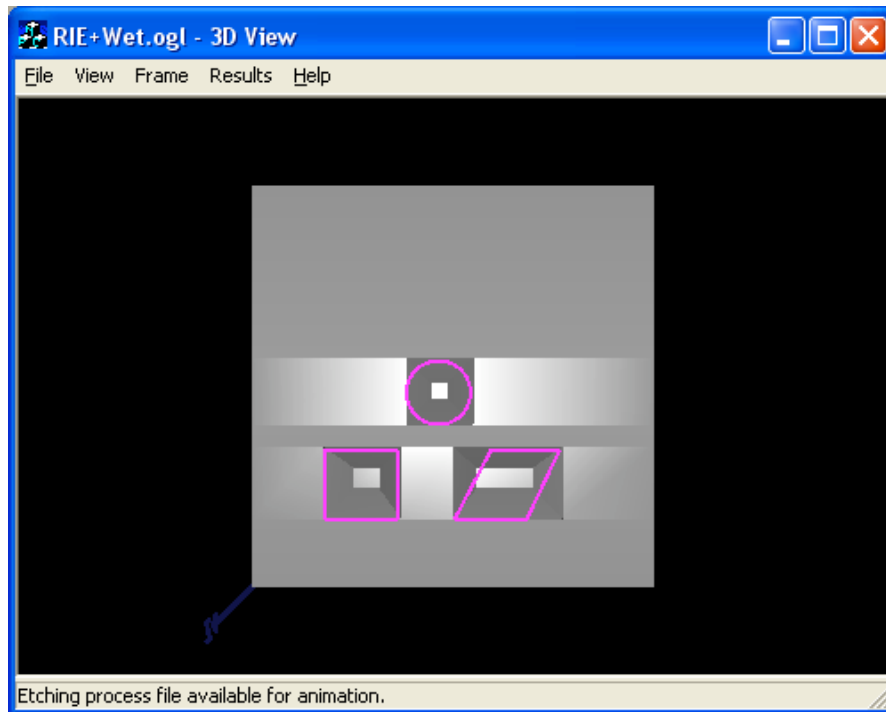


Figure 14: Structure After Wet Etch

Click *Frame...First Frame* to view the initial structure before the wet etching is started. You will see that it is the structure we obtained after performing the dry etch.

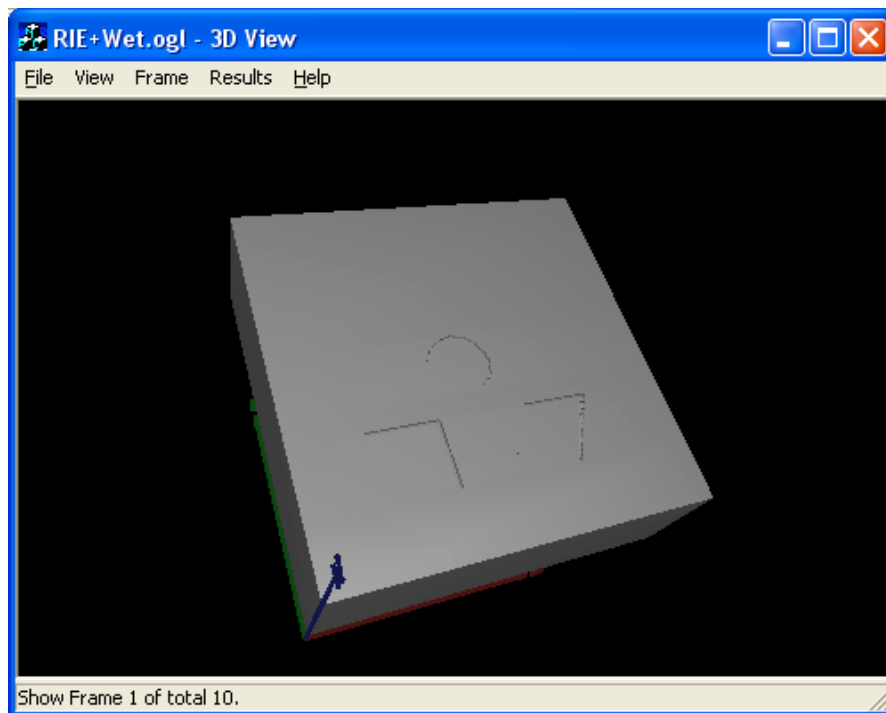


Figure 15: First Frame of Wet Etch Simulation