

Student Worksheet

Resist-ance is Useful

Safety

Wear safety glasses, protective gloves, and lab coats. Developer and dissolved resist may cause mild skin and eye irritation. Spills should be wiped up with plenty of water.

Introduction

Just as a painter will mask off areas that they do not want to be painted, microchip makers mask off areas of the silicon that they do not want to alter. They do this using a photoresist, which is a compound that can be patterned using ultraviolet (UV) light. It will then resist etching only in certain parts of the pattern. These lab activities explore photoresist masking and etching, essential parts of semiconductor manufacture.

Part 1: Lights, Developer, Pattern!

In this short, guided activity you will make a simple photoresist mask and etch this design onto a piece of metal. Afterwards, you will design your own patterns to etch into metal.

Materials

- unexposed photoresist sheet
- printed design on transparency
- metric ruler (mm)
- magnifying glass
- timer
- UV exposing unit
- developing tray
- developing solution
- rinsing water
- paper towels

Question

Do you think your pattern will look like the stencil, or the reverse?

Make a Prediction

Procedure

(Important: Keep your unexposed photoresist film in the protective pouch until you are in the darkened room.)

1. Make observations of your simple pattern in the space provided below.
2. Working quickly in the darkened room, remove the photoresist sheet from the protective envelope and put it on the black foam pad. Place your transparency on top of the sheet and weigh everything down with the glass plate.
3. Once all the groups have their sheets in place, place the exposing tray under the UV lamp. Expose the sheets with UV light for 60 seconds.
4. Remove the sheet and peel off the front and back protective films. Notice how the blue sheet looks now. Place the blue sheet in the developing tray and cover with a thin layer of developing solution.
5. With a sponge, use moderate pressure to rub the sheet on the front and back for 2 minutes until the blue material has been thoroughly removed from the patterned parts of the mesh.
6. Rinse the sheet thoroughly with water. Pat dry with a paper towel.
7. Once the sheets are developed, they can be used in well-lit areas. Make observations of the developed photoresist sheet using a magnifying glass and measurement tools.

Record Your Observations

1. Observations of original pattern (include a drawing, measurements and description):

2. Observations of developed photoresist (include a drawing, measurements and description):

Analyze the Results

1. What part of the film will resist the etching?

2. Some photoresist polymers are weakened by UV when the high energy light releases acid within the polymer. Other photoresist polymers form cross-links between their molecules when hit by UV light, making them stronger. Use your observations to justify: which of these two processes is happening to your blue film?

Draw Conclusions

Use your prediction, observations and analysis of the results to sum up this activity.
