
Photolithography Overview for Microsystems

Activity – Terminology

Instructor Guide

Notes to Instructor

This activity provides the participants an opportunity to better understand the terminology associated with Photolithography processing. Participants should read the PK before doing this activity in order to get an understanding of photolithography terminology.

This activity is part of the *Photolithography Overview for Microsystems Learning Module*:

- Knowledge Probe (pre-test)
- Photolithography Overview for Microsystems PK
- **Photolithography Terminology Activity**
- Photoresist Thickness Activity
- Final Assessment Participant – multiple choice

Description and Estimated Time to Complete

In this activity you demonstrate your knowledge of photolithography terminology. This activity consists of two parts:

- A **crossword puzzle** that tests your knowledge of the terminology and acronyms associated with photolithography processing, and
- **Post-activity questions** that ask you to demonstrate a better understanding of photolithography and its application to MEMS fabrication.

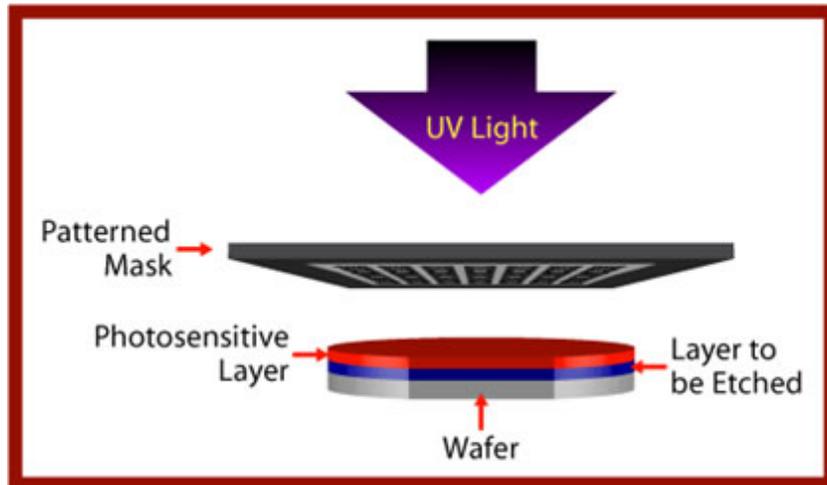
If you have not reviewed the unit *Photolithography Overview for Microsystems*, you should do so before completing this activity.

Estimated Time to Complete

Allow at least 30 minutes to complete this activity.

Introduction

Photolithography is the process that defines and transfers a pattern onto a layer of the wafer. In the photolithography process a light source is typically used to transfer an image from a patterned mask to a photosensitive layer (photoresist or resist) on a substrate or thin film. This same pattern is later transferred into the substrate or thin film (layer to be etched) using a different process (etch process).



For some layers, the resist pattern is used as a mask for a deposition process. In such cases, the patterned resist would identify the areas that receive the deposited material and the areas that do not.

Activity Objective

- Identify the correct terms used for several definitions or statements related to photolithography.
- Describe the photolithography process as it applies to microsystems fabrication.

Resources

SCME's *Photolithography Overview for Microsystems PK*

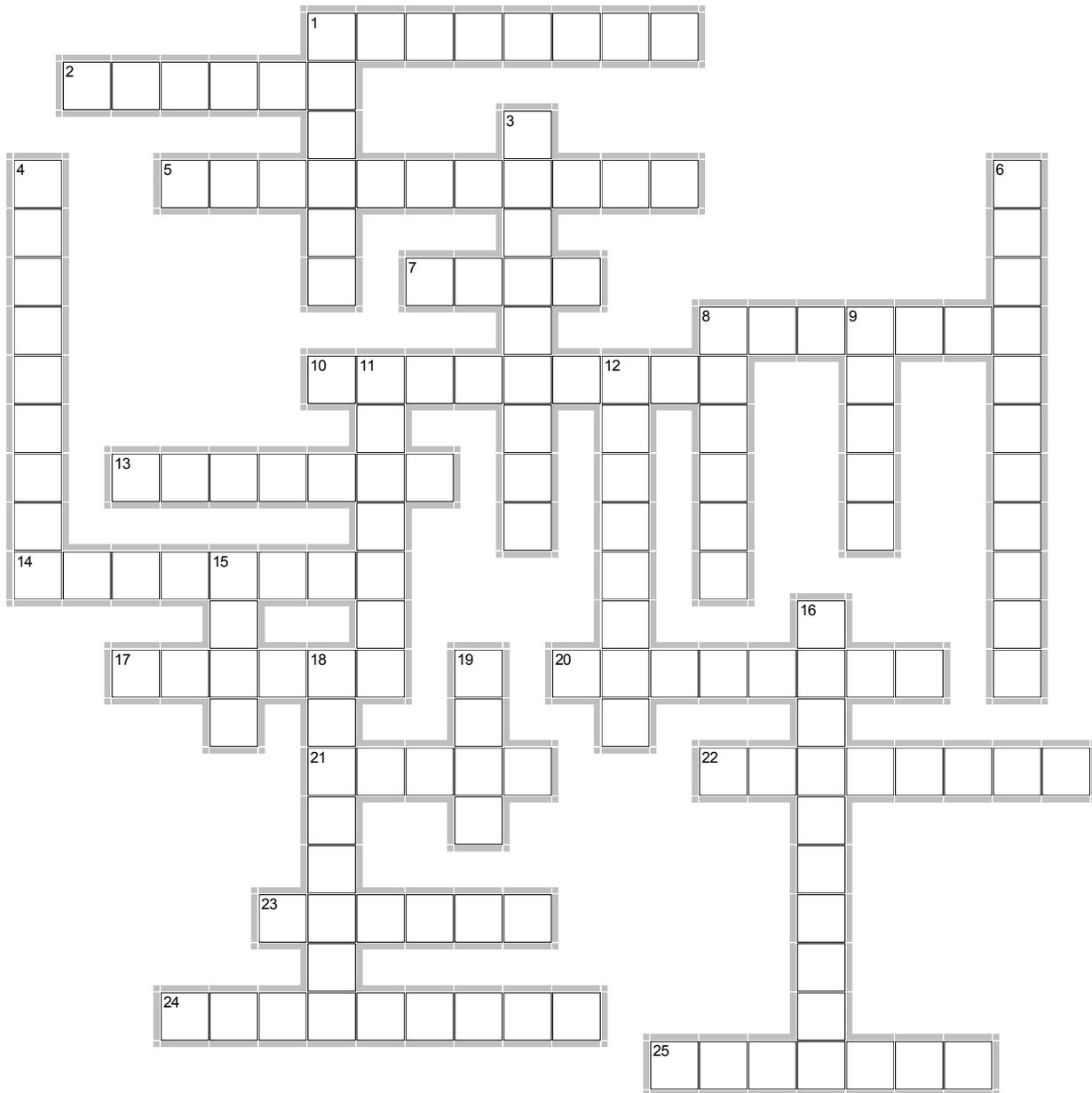
Documentation

1. Completed Crossword Puzzle
2. Questions and Answers to the Post-Activity Questions

Activity: Photolithography Terminology

Procedure:

Complete the crossword puzzle using the clues on the following page.



EclipseCrossword.com

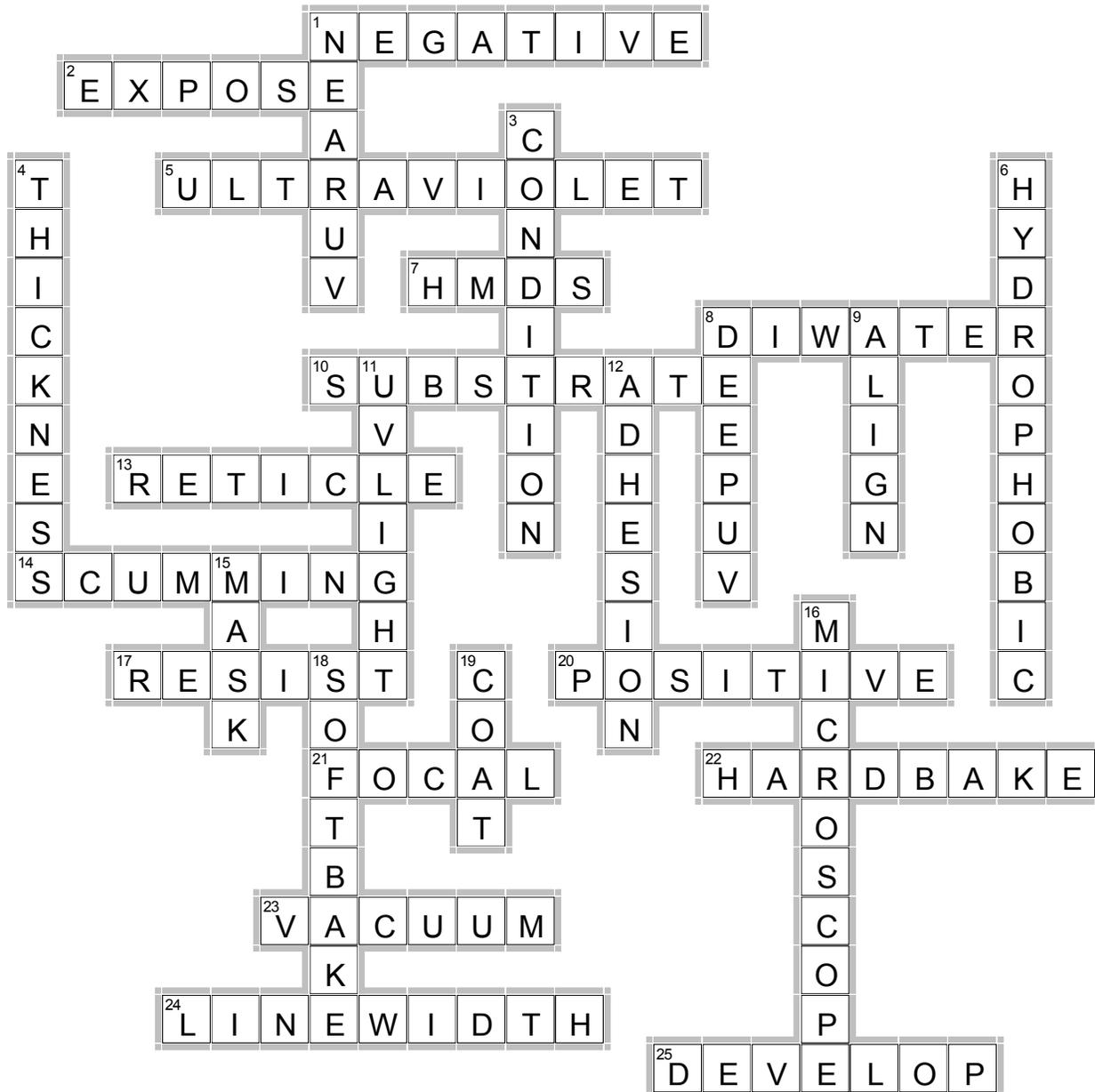
ACROSS	Answers
1. Type of resist that hardens when exposed to UV light	Negative
2. The photolithography step that transfers a pattern using a UV light source.	Expose
5. UV	Ultraviolet
7. Hexamethyldisilazane	HMDS
8. Used to stop the reaction of the chemical developer with the photoresist.	DI water
10. The base material or foundation on or in which MEMS components and circuits are constructed.	Substrate
13. A quartz plate, used in steppers, that has the pattern for one field or one or more die at one given layer.	Reticle
14. An underdeveloped or underexposed pattern results in this type of defect.	Scumming
17. A light sensitive thin film spun onto a wafer during the coat step of the photolithography process.	Resist
20. A type of resist that becomes more soluble in developer after being exposed to UV light.	Positive
21. During the exposure process, the wafer is adjusted in the z-axis and also may be tilted to adjust the _____ plane of the image.	Focal
22. The photolithography process step that hardens the photoresist after it has been developed.	Hardbake
23. A _____ holds the wafer on the chuck during the spin coating process step.	Vacuum
24. When you measure the critical linear dimension of a structure, you measure the _____ (2 words).	Line width
25. The removal of select photoresist material after exposure is done during the _____ process step.	Develop

DOWN	Answers
1. A portion of the electromagnetic spectrum (in the range of 300 nm – 400 nm) containing wavelengths often used to expose photoresist. (Hint: It is not DeepUV but _____.)	Near UV
3. Prepare the surface of the wafer for the coat process.	Condition
4. The resist parameter that is affected by rpm	Thickness
6. A fear of water	Hydrophobic
8. A portion of the electromagnetic spectrum (in the range of 100-250nm) containing wavelengths often used to expose photoresist. Due to the smaller wavelengths, this process can produce smaller structures.	Deep UV
9. To match (overlay) the pattern on one layer to the pattern on a previous layer.	Align
11. During expose, a chemical reaction takes place as the result of absorbing _____.	UV light
12. HMDS is used to promote the _____ of resist to the wafer's surface.	Adhesion
15. A quartz plate that contains the desired pattern for an entire wafer	Mask
16. High powered optical equipment used to inspect wafers at the end of the photolithography process.	Microscope
18. The photolithography process step that removes most of the solvents from the resist after the spin coat process.	Softbake
19. The application of resist to the wafer surface.	coat

Post-Activity Questions

1. Discuss the purpose of photolithography as it applies to the fabrication of microsystems.
2. Create an outline of the photolithography process.

Answer Key to Crossword Puzzle – Photolithography Terminology



EclipseCrossword.com

Post-Activity Questions / Answers

1. Discuss the purpose of photolithography as it applies to the fabrication of microsystems.

Answer: Answers will vary.

Microsystems fabrication uses several layers to build devices. These layers typically consist of thin films of metal, bulk silicon or polysilicon. Each layer is a different component of that device. Each layer requires a different pattern. Photolithography is the process step used to define and transfer a pattern to its respective layer. The photolithography process occurs several times during the fabrication of a microsystems device as layers build upon layers.

The steps of the photolithography process ensure that the layers are correctly aligned in order for the finished microsystem to function properly. It also ensures that the wafer is ready for any subsequent process steps.

2. Create a detailed outline of the photolithography process. Include primary and secondary steps of the process. *Answer:*

- 1) Coat Process
 - a) Surface Conditioning
 - i) Bake
 - ii) Prime (apply HMDS)
 - iii) Cool
 - b) Spin on Resist
 - c) Softbake
- 2) Align and Expose
 - a) Align
 - b) Expose
- 3) Develop
 - a) Immersion or Spray-on Develop
 - b) DI Rinse
 - c) Spin-dry
 - d) Hardbake
- 4) Inspect

Summary

Photolithography uses three basic process steps to transfer a pattern from a mask to a wafer: coat, develop, expose. Within each step are secondary steps that ensure the wafer is properly conditioned, the patterns are accurately aligned, and problems and defects are identified. The pattern is then transferred into the wafer's surface or an underlying layer during a subsequent process (such as etch). The resist pattern can also be used to define the pattern for a deposited thin film.

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