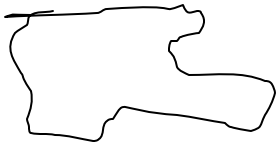
Practice Problems #2

1. You are using KOH etching to define a 200 μm thru-hole in a ⟨100⟩ wafer. What should the dimensions on your mask be if you are using a: a) 400 μm thick wafer b) 600 μm wafer. What would be the dimensions of the thru-hole be if you used the mask intended for the 400 μm thick wafer on the 600 μm thick wafer?

2. You are using KOH to etch ports in a 400 μm thick wafer. What minimum thickness of SiO_2 is needed to provide a mask for KOH etching. You are using 20% KOH at 60°C? If Si_3N_4 etches at 1.5 Å/min using the same conditions, how thick would it need to be to serve as a mask? (Hint: Use Appendix C in your textbook)

3. If the shape drawn below was used as a mask for KOH etching, draw a top and side view of what the hole would look like if allowed to go until only ⟨111⟩ planes are exposed. Assume the ⟨100⟩ planes are parallel to this page.



4. Draw the etch profile for the mask opening below for both an isotropic and anisotropic (crystal dependent) silicon etch assuming that the etch is allowed to continue until it just reaches the bottom edge of the substrate.

Isotropic Anisotropic

5. Calculate the amount of KOH that you would need to add to 1 L of water to produce a 30% by weight KOH etching solution.

6. Compare the advantages and disadvantages of using either an electrochemical or boron diffusion etch stop to produce a membrane using KOH as the etchant.

7. List five advantages that dry etching has when compared to wet etching. Also, list three of the most important disadvantages.

8. List the required methods and process chemistries required to deposit and etch a mask on a clean silicon wafer in preparation for KOH etching. Describe changes, if any, necessary for industrial automation.

9. Compare the advantages and disadvantages of anodic bonding, silicon fusion bonding, photopolymer bonding, and eutectic bonding.

10. List the steps you would take to anodically bond a silicon wafer to a glass slide.

11. Explain in less than 4 sentences how eutectic bonding works at the microscale.

12. What is the best way to bond two substrates?

13. Give four examples of the use of sacrificial materials to fabricate a device or structure.

14. What are the advantages of template replication techniques.

15. When would you use normal macro-machining techniques rather than micro-machining techniques?