Assignment #5: Due: 10/06/2011

1) Design Problem:

Design a fabrication process for a series of oxide lines on a silicon wafer. Assume that the line width is the critical dimension (the spaces between the lines are much larger). The oxide thickness is 0.1 micron.

i) Consider the design for four different cases of line width: 0.1, 0.5, 1.0, and 2.0 microns. In each case, describe the type of lithography you would use and why.

ii) If the line width on the optical mask were 0.1, 0.5, 1.0, and 2.0 microns, how would the resulting lines patterned in the oxide look if they were patterned using Buffered HF solution, RIE, and Ion milling. (Draw a cross section of the resulting structure with dimensions labeled)

iii) Select one linewidth, and list all the steps for fabricating the pattern starting with a blank substrate. For each fabrication step, draw a cross sectional view of the pattern. In addition, for each lithography step, draw an outline of the mask, indicate mask polarity (if applicable), and specify the type of photoresist (positive or negative).

2) A RIE dry etch was processed to etch a 1 um wide and 1 um tall polysilicon gate using a SiO_2 hardmask. The recipe used resulted in a very anisotropic etch with close to 90o sidewalls.

i) Draw a cross section diagram of this etch

You want to tailor the process so that the gate sidewalls are tapered (thinner on top and wider on the bottom). At the base of polysilicon gate needs to stay at 1 um wide, while the top of the gate needs to be thinner than 1 um wide.

ii) How would you change the process and/or equipment to tailor the recipe for such an etch profile? Draw cross section diagrams to help you explain your answer.

3) Essay:

Investigate TWO different lithography techniques for producing 3-dimensional structures in photoresist. For each technique, describe the concept and provide examples. Include a discussion evaluating the pros and cons of each technique, in terms of manufacturing.

Your response should be no more than 2 pages long (not including figures and references), single spaced, in Times New Roman font 11. You should provide a list of references used, including URLs if applicable. All submitted work must be original (ie in your own words).