3.155J/6.152J
Microelectronic Processing
Fall Term, 2005

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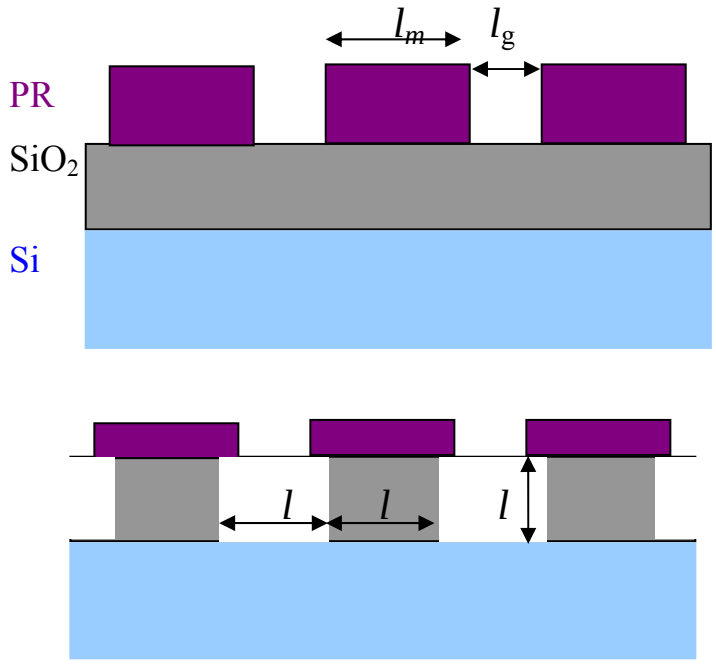
Problem Set 7 Out Nov. 14, 2005 Due Nov.21, 2005

1. You need to fabricate a diffraction grating of SiO_2 lines on Si. The lines are to have a square cross section, l x l, and a gap of l. See figure.

a) What must be the dimensions of the mask, l_m, and its window, l_g, in terms of l to achieve the desired grating. Assume the etch anisotropy is $A = 0.85$.

a) For etching completely through the SiO_2 film, $A = 1 - b/l$, so $b = 0.15\ l$. From the geometry in the figure, $l_m = l + 2b = l + 0.3l$. Thus $l_m = 1.3\ l$ and $l_g = 2l - l_m = 0.7l$.



b) Use Fig. 10-23 in Plummer (p. 28 in "dry etch" class notes) to determine the minimum thickness of photoresist applied in terms of l, if you are going to be using an etchant of 40% H_2 in CF_4 +H_2.

b) From the figure it appears that at 40% H_2, the etch rates of SiO_2 and photoresist are $r_{SiO2} \approx 42$ nm/min and $r_{PR} \approx 11$ or 12 nm/min, respectively. Thus, the photoresist must be at least 0.28 times the thickness of the SiO_2, so aim for at least $0.3l$ of PR.