3.155J/6.152J
Microelectronic Processing Technology
Fall Term, 2003

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Homework Set 2 Out: Sept. 17, 2003 Due: Sept. 24, 2003

Oxidation

Reading Assignment: Plummer 6.1-6.3, 6.5, 6.6 (or Campbell, Ch. 4).

1. Using the Deal-Grove model, calculate the thickness of silicon dioxide that will be grown using the following oxidation conditions and starting with an n-type (~$10^{15}cm^{-3}$) bulk wafer: begin with a dry oxygen environment for 20 minutes followed by a wet steam oxidation environment for 90 minutes and finish with a dry oxygen environment for 20 minutes. The entire oxidation process is carried out at 1000 C. Using the oxide thickness versus oxidation time figures on page 31 of your lab manual, determine the anticipated oxide layer thickness. Compare the calculated oxide thickness to that determined from the chart and comment on the differences.

2. Using both the Deal-Grove model and the figures in your lab manual, determine the oxide thickness using the following oxidation conditions: 60 minutes at 1000 C in a dry oxygen environment. Once again compare the two oxide thicknesses.

3. Polycrystalline silicon material is now used as the starting layer for the growth of a layer of silicon dioxide. The polycrystalline silicon is also heavily doped by the implantation of boron. How will the oxide growth rate be affected by the use of a polycrystalline layer of silicon compared to the use of a single crystalline silicon layer? How will the oxide growth rate be affected by the presence of boron atoms? Calculate the re-oxidation layer thickness using the following oxidation conditions and using the heavily-doped p-type polycrystalline material: at 950 C the oxidation conditions are 15 minutes of dry oxygen, followed by 7 minutes of wet steam oxidation, and then terminated with 15 minutes of a dry oxygen environment.