In the Name of GOD

HW set 2 — SSD - Fall 2016 – EE-SUT

Due date: 1395/08/02 — Prof. M. Fardmanesh

1. In the zone refining of silicon, an RF-heater is used to remove trace amounts of C and O from the silicon. If the silicon has 0.0001 atom % C and 0.001 atom % O in it, what would the purity of the leading edge after one pass of the zone refining? And after two passes? Assume that the liquid part is an ideal solution at these low impurity concentrations and that there are no interactions between C and O in the silicon melt and crystal. You should recognize that this is clearly a bad chemical assumption! Assume that the distribution coefficient for C and O in Si being 0.1 and 0.4 respectively at process temperature of 1500°C. Also find the purity of the crystal at 25cm away from the leading edge after one pass.

2. For LPCVD deposition of 300 nm SiO_2 on a 6 inch silicon wafer at T=400°C and P=300 mTorr, what is the volume of consumed gases (SiH_4 and O_2)? What is the deposition rate of silicon oxide for Silane flow rate of 50 sccm? Assume that 0.2% of gases absorb on the wafer surface and take participate in the below chemical reaction.

$$SiH_4 + O_2 \rightarrow SiO_2 + 2H_2$$

	Density
$SiO_2(s)$	2.65 gr/cm^3
$SiH_4(g)$	1.34 gr/lit.
$O_2(g)$	1.43 gr/lit.

3. In the chamber of a thermal evaporation system, a 1 inch Si wafer is placed at a height of 20cm above a small planar gold evaporation source. The evaporation flux is proportional to cosα where α is the angle that the flux makes with the normal to the plane source. How much gold would be required to deposit 100 nm thick gold layer on the Si wafer?