Semiconductor Process (EB68684)

Report 4 Assignment

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■ **How & When to submit your report :**

1. **Electronic submission: Submit your report in PDF via E-mail to** leedevicelab@gmail.com
2. **Deadline:** Nov. 22, 2019

■ **Answer the questions (problems) of the Chapter 5 with explanations and/or calculations:**

Chapter 5: Ion Implantation (4th elementary process)

Problem 5-1: Explain a basic principle of ion implantation process and each part of an implanter (see Fig.5.1).

Problem 5-2: Briefly explain the LSS theory and its limitation in terms of material structures, such as amorphous and crystalline phases.

Problem 5-3: Describe pros and cons of Ion implantation.

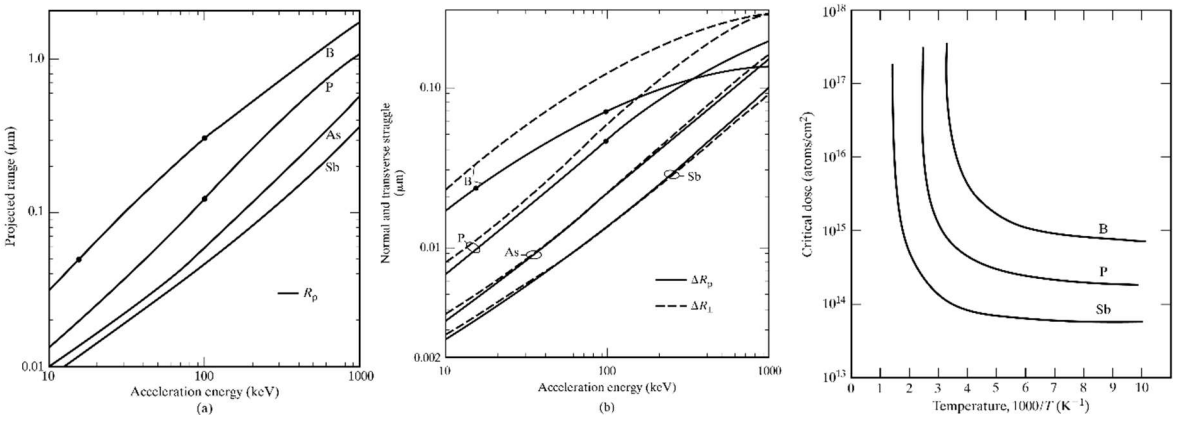
Problem 5-4: Provide a reason why we need the RTA rather than a typical thermal annealing in terms of 'Dt' product and impurity redistribution.

Problem 5-5: Explain what is the Channeling on <110> wafer, for example, and why it happens.

Problem 5-6: Describe a key difference between a Shallow implantation and High energy implantation with respect to the shape of profile and its mathematical model.

Problem 5-7: Briefly compare the implantation with diffusion process in terms of the dopant profile.

Problem 5-8: Phosphorus with an energy of 100keV is implanted into a silicon wafer with 300K ambient (refer to Figures below), and we haven't done an annealing after that:



(a) What are the range of straggle associated with this implantation?

(b) If this implantation is due to a critical dose, what is the peak concentration (Np) after the implantation?

(c) If the wafer has 10^{14} cm^{-3} as a background doping density of Boron (N_B), what is the junction depth and draw the profile.

(d) If this is a selective implantation for a locally naked silicon by a thick SiO_2 barrier layer. What is the minimum thickness of SiO2 required for this selective implantation?