

**Question:**

Why Silicon is the most widely used semi conductive material. Compare Silicon (Si) atom with a Germanium (Ge) atom?

**Answer:**

Silicon prevailed because it has superior physical and technological properties compared to the other semiconductor materials.

- Silicon is abundant in the earth crust as an ore in the form of quartzite,
- There are effective extraction and purification methods of silicon from its raw material.
- there are effective and economical crystallization methods for silicon.
- Silicon crystallizes in a diamond form with relatively strong bond gaining the crystals relatively strong mechanical properties which is advantageous for mechanical handling and processing.
- The energy gap of silicon is moderate resulting in a an intrinsic concentration of about one  $10^{10}/\text{cm}^3$ . Which is relatively low leading to small leakage currents.
- The maximum solid solubility of dopants is about  $10^{21}/\text{cm}^3$ . Therefore one can change the carrier type and concentration in a very large range for optimum operation of the devices.
- Easy doping by the suitable impurities . Development of powerful doping technologies
- Silicon dioxide has very superior characteristics enabled the planar technology one of the marking stone in semiconductor industry.
- Silicon dioxide is a building layer in the MOS devices which revolutionized the integrated circuits especially the digital ones.
- Silicon dioxide is used also as an insulator and passivation layer.
- Silicon has efficient response to solar radiation and light.
- Silicon has relatively high dielectric strength and therefore is suitable for power devices.

**Silicon has a larger bandgap energy than germanium, which contributes to higher junction potentials and ability to operate at higher temperatures.**

Silicon and Germanium atoms:

