



Electronics Devices (19EC31)

Class 9

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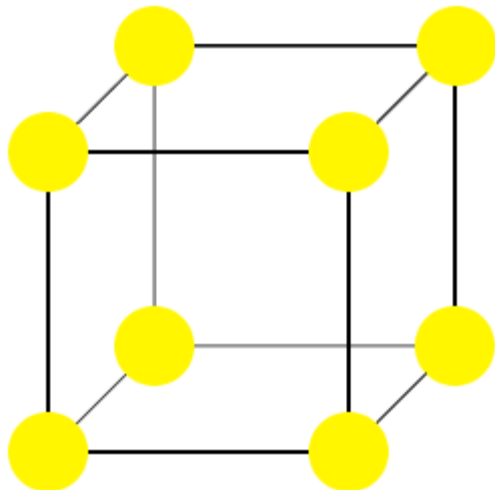


Scattering Mechanism

- The two basic scattering mechanism that influence electron and hole mobility are
 - Lattice Scattering(Phonon Scattering)
 - Impurity Scattering

Lattice Scattering

Lattice : A lattice is an ordered array of points describing the arrangement of particles that form a crystal





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Lattice Scattering

- Lattice Scattering--
- As Temperature increase, atoms randomly vibrates,
- This resulting in an collision between electrons and vibrating lattice atoms. Hence *Mobility decrease*.

Mobility due to lattice scattering, μ_L

$$\mu_L \propto T^{-3/2}$$

As temperature decreases, the probability of a scattering event decreases. Thus, mobility increases



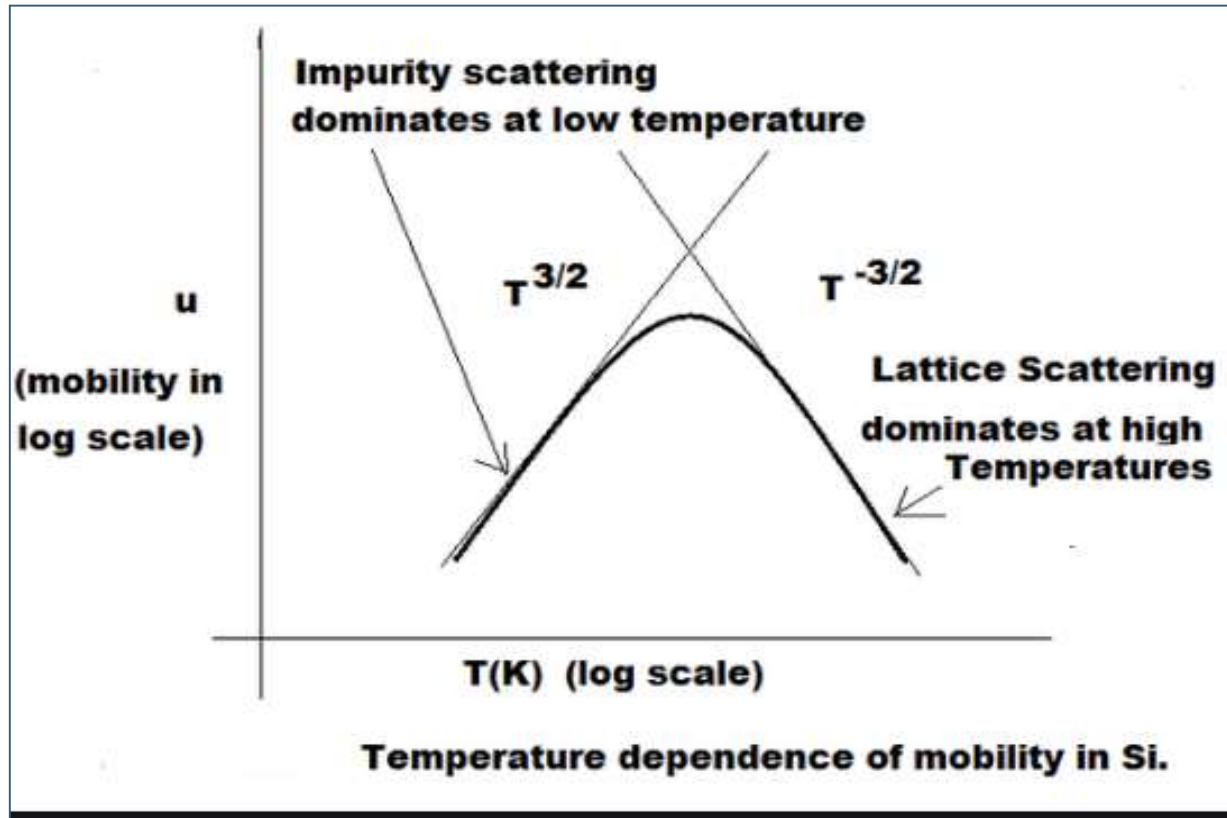
Impurity Scattering

- Impurity Scattering—
- Scattering of charge carriers with ionized impurities(dopants).
- This is the dominate mode of scattering in doped semiconductors.
- As the temperature decreases, impurity scattering increases, and the mobility decreases.

Mobility due to ionized ion scattering, μ_i

$$\mu_L \propto \frac{T^{3/2}}{N_I} \leftarrow \text{Total ionized impurity concentration}$$

Graph of Temperature vs Mobility



The net mobility is given by

$$\frac{1}{\mu} = \frac{1}{\mu_L} + \frac{1}{\mu_I}$$

Due to phonon scattering Due to ionized ion scattering



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Graph of Temperature vs Mobility

The net mobility is given by

$$\frac{1}{\mu} = \frac{1}{\mu_L} + \frac{1}{\mu_I}$$

Due to phonon scattering

Due to ionized ion scattering



Thank You

HAVE A NICE DAY