Fundamentals of Electronics Devices

Unit-4

Lecture-2

MESFET

- The depletion of the channel discussed for a JFET can be accomplished by the user of a reverse-biased Schottky barrier instead of a p-n junction.
- The resulting device is called a MESFET, indicating that a metal-semiconductor junction is used.

GaAs MESFET

- The substrate is undoped or doped with chromium, which has an energy level near the center of the GaAs band gap.
- In either case the Fermi level is near the center of the gap, resulting in very high resistivity material (~10ˆ8 Ω-cm), generally called semi-insulating GaAs.

MESFET Designing

- On this nonconducting substrate a thin layer of lightly doped n-type GaAs is grown epitaxially, to form the channel region of the FET.
- The photolithographinc processing consists of defining patterns in the metal layers for source and drain ohmic contacts (e.g., Au-Ge) and for the Schottky barrier gate (e.g., Al).

Intoduction

- By using GaAs instead of Si, a higher electron mobility is available, and furthermore GaAs can be operated at higher temperatures (and therefore higher power levels).
- Since no diffusions are involved, close geometrical tolerance can be achieved and the MESFET can be made very small.

Implementation

- It is possible to avoid the epitaxial growth of the n-type layer and the etched isolation by using ion implementation.
- Starting with a semi-insulating GaAs substrate, a thin n-type layer at the surface of each transistor region can be formed by implementing Si or a column VI donor impurity such as Se.

- This implementation requires an anneal to remove the radiation damage, but the epitaxial growth step is illuminated.
- In either the fully implanted device or the epitaxial device, the source and drain contacts may be improved by further n^+ implementation in these regions.