Emerging & Low Dimensional Materials: [PHYS-789]

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Contents

1 Wednesday, January 17:

1.0.1 Doping, Transistor Characteristics & FETs

- Doping: adding impurities to a semiconductor to change its electrical properties.

  - n-type: add electrons (donor)

  - p-type: add holes (acceptor)

- Transistor: a semiconductor device used to amplify or switch electronic signals and electrical power.

  - BJT: bipolar junction transistor

  - FET: field-effect transistor

- FET: a transistor in which current flows through a semiconductor channel whose width is modulated by an electric field.

  - MOSFET: metal-oxide-semiconductor field-effect transistor - Family of curves: I_D vs V_{DS} for different values of V_{GS} - Saturation: $V_{DS} > V_{GS} - V_{TH}$

1.0.2 Logic Gates

- Inverter: V_{out} = inverse of V_{in}

1.0.3 What are 2D & low dimensional materials?

Crystalline single layer materials with thickness of a few atoms.

0D, 1D, 2D, 3D materials.

- 0D:
- 1D: Carbon nanotubes, nanowires.
- 2D: Graphene, transition metal dichalcogenides (TMDs), black phosphorus, hexagonal boron nitride (hBN).
- 3D: Bulk materials.