

TEMPERATURE DEPENDENCE ON DENSITY OF STATES AND CARRIER CONCENTRATIONS OF SEMICONDUCTORS

ABDULRAHMAN MUFRAH WADANI

Physics department- Science College

Jazan University

Abstract:

General properties of the elemental semiconductors namely Silicon (Si) and Germanium (Ge) and Gallium Arsenide (GaAs) compound semiconductor were discussed. The generation and recombination of the carrier concentrations of intrinsic and extrinsic semiconductors were reviewed. The effective density of states at conduction band (N_c) and valance band (N_v) and intrinsic carrier concentrations of Si, Ge and GaAs at different temperatures in the range (70K-500K) were calculated. The values of N_c and N_v are different for all the materials under study at different temperatures with N_v is less than N_c due to the difference in the effective masses of electrons and holes resulted from their interactions with the periodic potential of the lattice and the shape of the energy bands in three-dimensional k-space. intrinsic carrier concentrations (n_i) of Si, Ge and GaAs materials for different temperatures shows that the value of n_i for lower band gap material is higher than that of higher band gap material and as the temperature increased the carrier concentrations increased. At very low temperatures the carriers are very small and the materials behave as insulators. At higher temperatures say above 350 K the intrinsic carrier concentrations become high and the materials behaves like intrinsic.

Keywords: Si, Ge,, GaAs, Density of states, carrier concentration