

1. (a) Describe the physical meaning of Fermi level. (b) When the temperature of n-type semiconductors increase, describe the position change of the Fermi level. (20分)
2. Explain how to measure the concentration of semiconductor, give two examples. (20分)
3. For n-type semiconductors with doping concentration of $5 \times 10^{16} \text{cm}^{-3}$ and $5 \times 10^{18} \text{cm}^{-3}$, when the temperature of the semiconductors increase from 10K to 500K, describe and draw the mobility as a function of temperature. (20分)
4. (a) Describe the Schottky and ohmic mechanisms for metal-n type semiconductor and draw the band diagram. (b) Describe the advantages of heterostructure applied in optoelectronic devices, give an example. (20分)
5. Consider a silicon pn junction at $T=300\text{K}$ so that $n_i=1.5 \times 10^{10} \text{cm}^{-3}$. Assume the n-type doping is $1 \times 10^{16} \text{cm}^{-3}$ and assume that a forward bias of 0.6V is applied to the pn junction. Calculate the minority carrier hole concentration at the edge of the space charge region. (20分)