

Problem Set #12: Contacts and Surfaces

1. Identify each of the following metal-semiconductors contacts as ohmic or as rectifying (assume ideal interface):

(i) n-type semiconductor ($\phi_s > \phi_m$)

(ii) n-type semiconductor ($\phi_s < \phi_m$)

(iii) p-type semiconductor ($\phi_s > \phi_m$)

(iv) p-type semiconductor ($\phi_s < \phi_m$)

2. Both rectifying and ohmic contacts are to be fabricated by depositing a particular metal on a silicon integrated circuit. Considering the ideal metal-semiconductor contact, determine the allowable range of doping concentration in silicon to form: (i) a rectifying contact, (ii) an ohmic contact. Consider both n-type and p-type silicon. Use the following data:

$$\phi_{\text{metal}} = 4.4\text{eV}$$

$$E_g \text{ for Si} = 1.12\text{eV}$$

$$\text{Electron affinity for Si } (\chi_{\text{Si}}) = 4.01\text{eV}$$

3. Describe at least one application where you would want: (i) a rectifying contact, (ii) an ohmic contact.