Tutorial problems and questions

1. Calculate the number of broken bonds per unit area in a Nickel crystal on the (111), (110) and (100) planes.

   Answer

   Calculate the number of broken bonds per unit area in a Nickel crystal on the (111), (110) and (100) planes.

   Ni is fcc and the lattice parameter of Ni is 3.52 Å. There are two atoms on a (100) plane. Hence the density of atoms per unit area of a (100) plane of a Ni crystal is 1.61 $\times 10^{19}$. For preparing the (100) surface, foreach atom 4 bonds are broken; however, since each bond is common to two atoms, the total number of bonds broken per atom is 2. Hence, total number of broken bonds are 3.22×10^{19}.

   Similarly, number of atoms per unit area on the (110) plane is 1.142 $\times 10^{19}$ and the number of atoms per unit area on the (111) plane is 1.864 $\times 10^{19}$. On (110) plane, the number of broken bonds per atom is 2.5 and on the (111) plane the number of broken bonds are 1.5. Hence, the total number of broken bonds can be calculated by multiplying these numbers with the atomic densities.

2. Calcualte the number of atoms per unit area in an Iron crystal on the (111), (110) and (100) planes.

   Answer

   Calcualte the number of atoms per unit area in an Iron crystal on the (111), (110) and (100) planes.

   Fe is bcc and the lattice parameter of Fe is 2.87 Å. Hence, the number of atoms per unit area of the (100), (110) and (111) planes of Fe are 7 $\times \times 10^{18}$, 1.72×10^{19} and 1.21 $\times 10^{19}$.