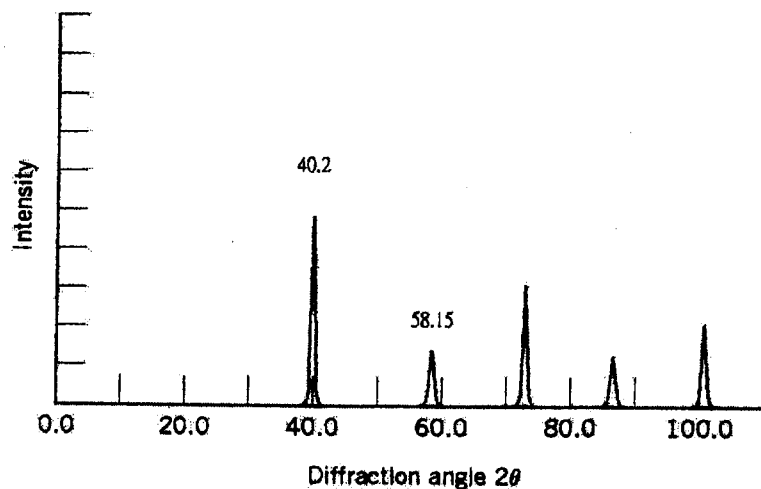本試題是否可以使用計算機： ☑可使用 ， □不可使用 （請命題老師勾選）

1. Shortly explain or define the following terms (a) covalent bonding (b) Frankel defect (c) screw dislocation (d) eutectic reaction (e) dielectric loss factor. (15%)

2. Consider the bonding between A and B atoms, where the A atom has a electronnegativity = 1 and electron configuration = $1s^2 2s^2 2p^6 3s$, while the B atom has a electronnegativity = 2.9 and electron configuration = $1s^2 2s^2 2p^6 3s^2 3p^5$. What kind of bonding is probably formed between A and B atoms? (a) metallic bonding (b) covalent bonding (c) ionic bonding. (5%)

3. Which tool is usually used to examine the surface morphology of a material (a) scanning electron microscopy (b) x-ray diffraction (c) photoluminescence spectroscopy (d) Hall measurement. (5%)

4. Consider the (a) and (b) hysteresis loops, which one is a softer magnetic material? (5%)
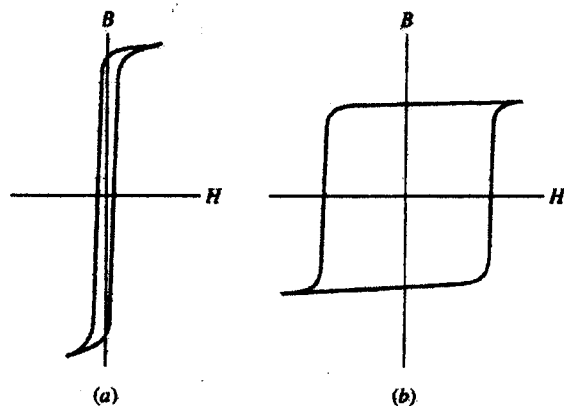
5. Using a 0.1542 nm Cu-Kα x-ray, we get an x-ray diffraction pattern of metallic tungsten (W). (a) What is the possible crystal structure of this material? Assume that it is either FCC or BCC. (b) Label each diffraction peak referring to its corresponding plane. (c)Determine the interplanar spacing for the first peak from low angle side. (d) Determine the atomic radius. (20%)

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6. A n-type Si wafer has been doped uniformly with 10^{16} antimony (Sb) atom/cm³. Calculate the position of the Fermi energy with respect to the Fermi energy E_{Fi} in intrinsic Si. The above n-type Si sample is further doped with 2×10^{17} boron atom/cm³. Calculate the position of the Fermi energy with respect to the Fermi energy E_{Fi} in intrinsic Si. (Assume that T=300K, and kT=0.0259eV) (15%)

7. Please compare the effect of temperature on the conductivity for metal, inorganic semiconductor, organic semiconductor and insulator. (15%)

8. Given that the density of states related effective masses of electrons and holes in Si are approximately $1.08m_e$ and $0.6m_e$, respectively, and the electron and hole drift mobilities at room temperature are 1350 and 450 cm²/Vs, respectively., calculate the intrinsic concentration and intrinsic resistivity of Si.(20%) ($m_e=9.1 \times 10^{-31} kg$, $h=6.63 \times 10^{-34} Js$, $k=1.38 \times 10^{-23} J/K$, $E_g(Si) =1.1eV$)

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