

國立臺北科技大學

九十三年年度工程科技研究所博士班入學考試

材資組 材料科學與工程導論試題

填准考證號碼

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注意事項：

1. 本試題共七題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. Describe the mechanisms of atomic bonding in materials.(15%)
2. MgO has the same crystal structure as NaCl.
 - (a). Calculate the packing factor and density of MgO. (10%)
 Note that $r_{Mg}=0.66\text{\AA}$, $r_O=1.32\text{\AA}$; $m_{Mg}=24.31\text{ g/g.mol}$, $m_O=16\text{ g/g.mol}$.
 - (b). Calculate the attractive bonding force between Mg and O in MgO if the interionic distance is 0.210nm. (5%)
 Note that the charge of a single electron is $0.16\times 10^{-18}\text{ coul}$,
 proportionality constant is $9\times 10^9\text{ V.m/coul}$.
3. Describe the strengthening mechanisms in materials.(15%)
4. Explain the Fick's first law and Fick's second law at which atoms diffuse in a material. (10%)

5. (a). Sketch the Fe-C binary phase diagram .(5%)
(b). Explain the A_1 、 A_2 、 A_3 transformation .(5%)
(c). What is the distinction between steel and cast iron .(5%)

6. (a). When a magnetic field is applied to a collection of atoms, how many types of magnetic behavior may be observed ? (8%)
(b). Would you expect the magnetic behavior of Fe and Fe_3O_4 ? (7%)
(c). What is the distinction between soft magnetic materials and hard magnetic materials ? (10%)

7. Fe powder with a theoretical density of 7.86g/cm^3 is thoroughly mixed with 1 wt% Zn stearate(theoretical density is 1.09g/cm^3) . What is the theoretical density for the mixture ? (5%)