

大同大學 108 學年度 (暑)轉學入學考試試題

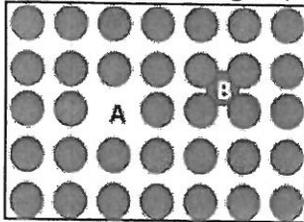
考試科目:材料導論 系別:材料工程學系 第 1 頁

註:本次考試 不可以參考自己的書籍及筆記 ; 不可以使用字典 ; 不可以使用計算器。

1. Identify the three crystal structure: Body-Centered Cubic (BCC), Face-Centered Cubic (FCC), Hexagonal Close-Packed (HCP). (r : radius of sphere and a : length of cube side) (28%)

Crystal Structure	Atom/ unit cell	The relation between r and a	Coordination number	Atomic packing factor (APF)	Close-packed planes (Miller indices)
BCC	(1)	(2)	(3)	(4)	(5)
FCC	(6)	(7)	(8)	(9)	(10)
HCP	(11)	(12) $a=2r, c=1.633a$	(13)	(14)	(15)

2. () In below figure, A or B indicate **self-interstitial**. (4%)



3. **Definition and Cite the difference**

(a) substitutional and interstitial solid solutions (4%)
 (b) mechanical and annealing twins. (4%)

4. An FCC iron-carbon alloy initially containing 0.20 wt% C is carburized at an elevated temperature and in an atmosphere wherein the surface carbon concentration is maintained at 1.0wt%. If after 49.5 h the concentration of carbon is 0.35 wt% at a position 3.5 mm below the surface, determine the **temperature** at which the treatment was carried out. (10%)

Table. Tabulation of Error Function Values

z	$erf(z)$	z	$erf(z)$	z	$erf(z)$
0	0	0.55	0.5633	1.3	0.9340
0.025	0.0282	0.60	0.6039	1.4	0.9523
0.05	0.0564	0.65	0.6420	1.5	0.9661
0.10	0.1125	0.70	0.6778	1.6	0.9763
0.15	0.1680	0.75	0.7112	1.7	0.9838
0.20	0.2227	0.80	0.7421	1.8	0.9891
0.25	0.2763	0.85	0.7707	1.9	0.9928
0.30	0.3286	0.90	0.7970	2.0	0.9953
0.35	0.3794	0.95	0.8209	2.2	0.9981
0.40	0.4284	1.0	0.8427	2.4	0.9993
0.45	0.4755	1.1	0.8802	2.6	0.9998
0.50	0.5205	1.2	0.9103	2.8	0.9999

Diffusing species	Host metal	D_0 (m^2/s)	Activation energy Q_d (KJ/mol)
C	γ -Fe (FCC)	2.3×10^{-5}	148

5. Define **Yield strength** at a strain offset of 0.002 for typical tensile stress-strain behavior of a metal. (5%)
6. What is the relationship between dislocations and plastic deformation of metals? (10%)
7. What is the driving force for grain growth? (10%)
8. What is plain strain fracture toughness (K_{IC})? (5%)
9. Why does heterogeneous nucleation occur more readily than homogeneous one? (10%)
10. Plot a typical eutectoid microstructure (e.g., pearlite in carbon steel). (10%)