

國立高雄大學 112 學年度研究所碩士班招生考試試題

科目：材料科學導論

系所：化學工程及材料工程學系

考試時間：100 分鐘

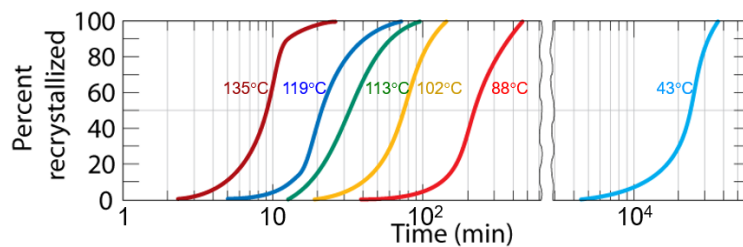
(無組別)

是否使用計算機：是

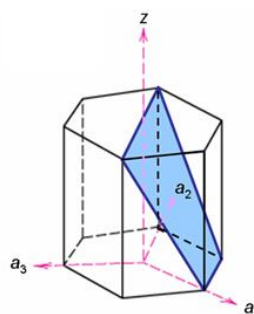
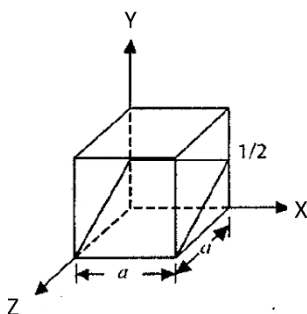
本科原始成績：100 分

Part I 30%

- () What are coordination number for BCC and FCC? (a) 6, 8 (b) 4, 6 (c) 8, 12 (d) 12, 8 (e) 6, 12 (f) 12, 6
- () Zinc has a HCP structure with lattice constant of $a = 0.266 \text{ nm}$, $c = 0.495 \text{ nm}$. What is the planar density in the (0001) plane (a) 6.3 (b) 8.3 (c) 12.3 (d) 14.3 (e) 16.3 (f) 18.3 nm^{-2}
- () Calculate linear densities in $[11\bar{2}0]$ and $[0001]$ direction of Zinc (a) 2.02 and 3.76 nm^{-1} (b) 3.76 and 2.17 nm^{-1} (c) 2.17 and 2.02 nm^{-1} (d) 2.17 and 3.76 nm^{-1} (e) 3.76 and 2.02 nm^{-1} (f) 3.76 and 2.02 nm^{-1}
- () The figure shows the rate of phase transformation at different temperature, the recrystallization should be (a) nucleation control (b) growth control (c) both of the above (d) none of the above



- () What's the angle between $[1\bar{1}00]$ and $[11\bar{2}0]$? (a) 30° (b) 45° (c) 60° (d) 75° (e) 90° (f) 120°
- () Determine the indices for the planes shown in the following cells. (a) $(11\bar{2}0)$ and (102) (b) $(10\bar{1}1)$ and (120) (c) (021) and $(10\bar{1}1)$ (d) $(11\bar{2}0)$ and (201) (e) $(10\bar{1}1)$ and (210) (f) $(10\bar{1}1)$ and (201)



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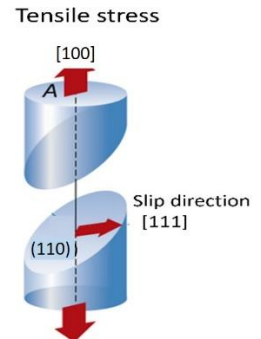
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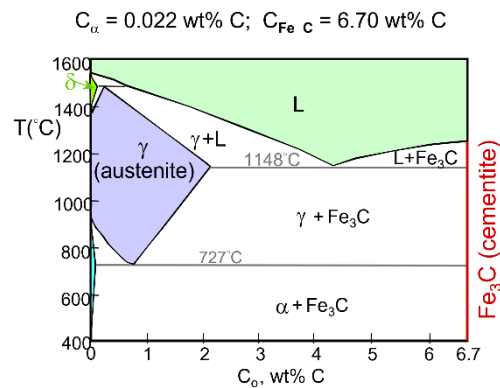
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Part II 70%

1. (10%) A tensile stress of 360 MPa is applied along the [100] direction of a single crystal of BCC Fe. Compute the resolved shear stress along the (110) plane and in the [111] direction.



2. (20%) For a 99.7 wt% Fe-0.3 wt% C steel at a temperature just below the eutectoid, determine the following
- composition of Fe_3C and ferrite (α)
 - the amount of carbide (cementite) in grams that forms per 100 g of steel
 - the amount of pearlite and proeutectoid ferrite (α) per 100 g of steel
 - plot schematic microstructure of the steel



3. (25 %)

- Explain the physical meaning of Bragg's law by figures, formulas, and words.
- There is an FCC polycrystalline metal with a lattice constant of 2.67 Å, try to find d-spacings of the (111) plane.
- Estimate the Bragg angle corresponding to the first-order diffraction of the (111) plane in the XRD pattern. (wavelength of X-ray: 0.154 nm)
- estimate the atomic radius of the metal

4. (15 %)

As shown in the figure, explain the flowing phenomena by microscopic mechanisms:

- resistivity of metal increase with temperature
- resistivity of semiconductor decrease with temperature
- resistivity of alloy is larger than that of pure metal

