

大同大學 100 學年度研究所碩士班入學考試試題

考試科目：物理冶金

所別：材料工程研究所

第1/2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； 可以使用計算器。

- 是非題() The driving force for recrystallization comes from the stored energy of cold work. In those cases where polygonization is essentially completed before the start of recrystallization, the stored energy is supposed to be confined to the dislocations in polygon walls. (5%)
- 是非題 Please write down the answers (right or wrong) for the following statements about the critical resolved shear stress (τ_c) and slip systems observed in FCC/HCP/BCC. (5%)
 - () (a) The τ_c on basal slip for Zn, Cd and Mg crystals is large. Right or wrong?
 - () (b) Zn, Cd and Mg crystals harden rapidly with increasing strain. Right or wrong?
 - () (c) The τ_c for FCC metals is small. Right or wrong?
 - () (d) The τ_c for BCC metals is small. Right or wrong?
 - () (e) FCC metals often harden rapidly with increasing strain. Right or wrong?
- 是非題 () (a) The temperature range of dynamic strain aging (DSA) increases to higher temperature with increasing strain rate. Right or wrong? (2%)

是非題() (b) Flow stress is dependent of temperature or strain rate when DSA occurs. Right or wrong? (3%)

選擇題

- For interstitial diffusion in a face-centered cubic lattice, α in the diffusion equation $D = \alpha a^2 / \tau_c$ equals (a) 1/12, (b) 1/6, (c) 1/18, (d) 1/24. (5%) (單選)
- For nucleation of solid to solid, the strain energy is dominant for large particle, which of the following particle shape is stable? (a) Sphere (b) Disc. (3%) (單選)
- For the FCC crystal structure, please rank these planes (100), (110), and (111) in order of their accommodation factor during freezing, which of the followings is true: (a) $AF(100) > AF(110) > AF(111)$, (b) $AF(111) > AF(100) > AF(110)$, (c) $AF(110) > AF(100) > AF(111)$, (d) $AF(111) > AF(110) > AF(100)$. (3%) 單選
- Temperature inverse will result in which one of the followings: (a) thermal supercooling (b) constitutional supercooling. (3%) (單選)
- Which of the followings is caused by small constitutional supercooling: (a) coring (b) cellular structure (c) wormhole? (3%) (單選)
- There is no central zone in ingots of pure metals because of (a) no thermal supercooling or (b) no constitutional supercooling. Which one? (3%) (單選)
- 填充題 When a dislocation moves on its glide plane, it might pass through other dislocations lying in the same glide plane and leave various types of step after intersection. The steps may lie in the glide plane of a dislocation or on another glide plane. The former is called a kink, while the latter a junction. (5+5%)

<背面繼續>

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第2/2頁

$$\frac{V_{FCC} - V_{BCC}}{V_{BCC}}$$

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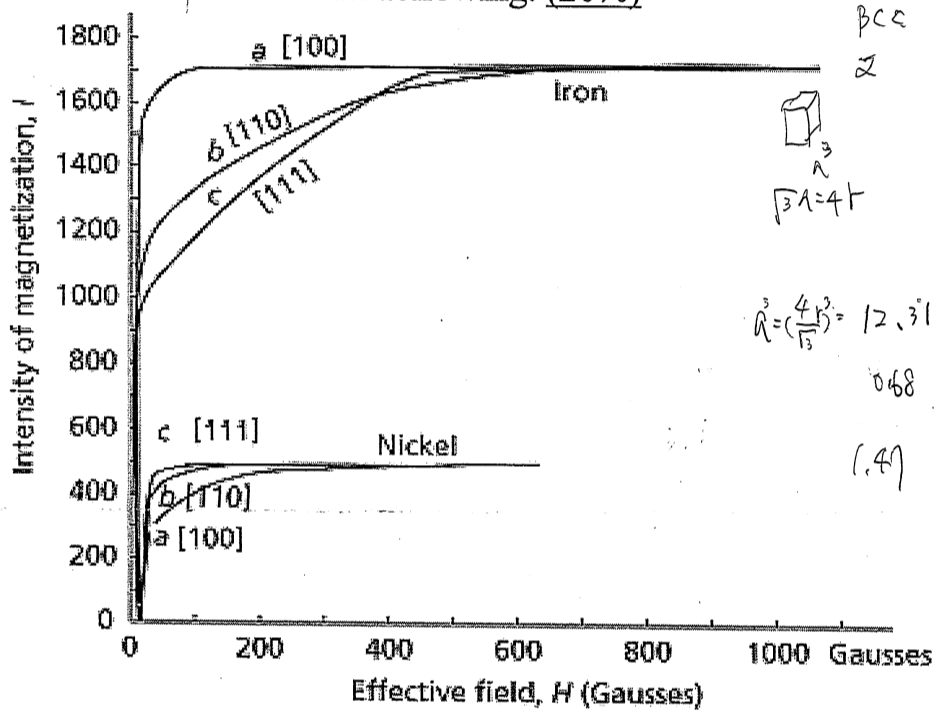
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$\beta_{CC} \rightarrow FCC$
 $\frac{4}{3}\pi r^3$
 $\sqrt{3}a = 4r$
 $a^3 = \left(\frac{4r}{\sqrt{3}}\right)^3$

問答/計算題

11. Iron has a BCC structure at room temperature. When heated, it transforms from BCC to FCC at 1185K. The atomic radii of iron atoms at this temperature are 0.126 and 0.129 nm for BCC and FCC, respectively. What is the percentage volume change upon transformation from BCC to FCC? (15%)

12. Compare the anisotropy and magnetic property between iron and nickel with the aid of the six magnetization curves shown in the following. (20%)



13. For the interactions between electron beam and materials, please explain the following nouns:

(a) EDX (b) Auger electron (c) secondary electron (d) backscattered electron (e) TEM. (10%)

14. Compare superlattice with miscibility gap (phase separation) by phase diagrams. (5%)

15. For the torsion pendulum with a vanadium wire containing nitrogen, discuss how the pendulum period and temperature affect the specific damping capacity of this vanadium wire and determine the τ_R and diffusivity. (5%)