

# 國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：材料科學【材光系碩士班丙組】

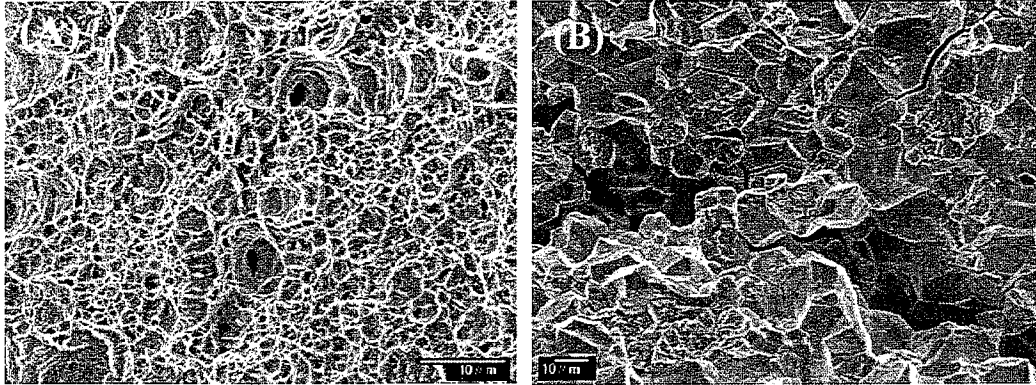
題號：4103  
共 2 頁 第 1 頁

- (1) Derive Fick's second law for diffusion. For each step of your derivation, you must explain the meaning of your equation, otherwise, you will not be able to gain any score! 8 points
- (2) An important property of a material is its strength. Explain what is the strength of a material? 8 points
- (3) What is the importance of phase diagrams in materials science? 8 points
- (4) Why the properties of a material in single crystal form are very much different from the properties of the material in polycrystal form? 8 points
- (5) What are the factors that may cause the formation of grain boundary precipitation-free zone in a precipitation-hardened alloy? 8 points
- (6) Give a schematic drawing that has 3m symmetry. 8 points
- (7) Describe the detailed specimen preparation procedure for metallic materials to be examined under an optical microscope. 8 points
- (8) In a stainless steel, partial dislocation pairs with Burgers vectors of  $1/6[11\bar{2}]$  and  $1/6[\bar{1}2\bar{1}]$  are found. What may be the slip plane of these partial dislocations? Under what situation, these partial dislocations can cross-slip? If these partial dislocations would be able to cross-slip, what would be the cross-slip plane? 8 points
- (9) Explain the following terms:
  - (a) Misorientation of a grain boundary. 4 points
  - (b) Dielectric material. 4 points
  - (c) Hall effect. 4 points
  - (d) Piezoelectric materials 4 points
  - (e) Soft magnetic material. 4 points
- (10) By studying the fracture surface of a material, we can obtain useful information of this material. The photos shown below are taken from two different steels. Discuss the fracture mode of these two steels. 8 points

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共 2 頁 第 2 頁



(11) The structure of an fcc alloy was studied by X-ray diffractometer. After two different heat treatment conditions, two different diffraction patterns were obtained, as shown below. Discuss the effect of heat treatment on the structure of this alloy.

8 points

