

※考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

機械材料試題 (題號 1~6)

- 1、試以應力-應變曲線特性及斷面結構特徵，說明脆性破壞(brittle fracture)與延性破壞(ductile fracture)之區別。(8%)
- 2、請說明體心立方(BCC)結構在(100)平面與(110)平面的表面能(surface energy)何者為大？何故？(8%)
- 3、一合金鋼經滲碳處理(carburizing heat treatment)12 小時後，在距離表面 2.6mm 處之碳含量為 0.45wt%；若在相同的溫度下，需時多久才能在距離表面 5.1mm 處有相同的 0.45wt%碳含量。(8%)
- 4、黃銅合金在拉伸頸縮前，當工程應變(engineering strain)分別為 0.194 及 0.296 時，其對應之工程應力(engineering stress)分別為 235MPa 及 250MPa，試根據這些資料，計算出工程應變為 0.25 時其工程應力值為何？(8%)
- 5、單晶滑移時其分解剪應力可寫成 $\tau_R = \sigma \cos \phi \cos \lambda$ ，其中 $\cos \phi \cos \lambda$ 稱為 Schmid factor，今有一面心立方(FCC)結構之單晶沿[100]方向承受荷載，試計算其 Schmid factor 值之大小。(10%)
- 6、波來鐵(pearlite)與變韌鐵(bainite)皆含有肥粒鐵(α , ferrite)及雪明碳鐵($F_{e_3}C$, cementite)，試配合圖示說明兩者生成的方式有何不同？(8%)

機械製造試題 (題號 7~10)

7. A linearly strain-hardening material with a stress-strain curve $\sigma=1,000+5,000\varepsilon$ (psi) is being drawn into a wire. If the original diameter of the wire is 0.4 in., what is the minimum possible diameter at the exit of the die? If there is no redundant work and the friction work is 25% of the ideal work of the deformation. (10%)
8. (a) A cylinder with a height to diameter ratio of 1.0 solidifies in 3 minutes in a sand casting process. What is the solidification time if the height of the cylinder is doubled? What is the solidification time if the diameter is doubled? (10%)
(b) How can you tell whether cavities in a casting are due to porosity or to shrinkage? (5%)
9. A rectangular workpiece has the original dimensions (120 mm x 30 mm x 20 mm). The metal has a stress-strain curve $\sigma=800\varepsilon^{0.2}$ (MPa). It is being forged in plane strain with $\mu=0.1$. Calculate the force required for the height to be reduced by 20% of the original height (30 mm). (15%)
10. (a) Ceramic cutting tools have certain advantages over carbide tools. Why are they not replacing carbide tools? (5%)
(b) List and explain factors that contribute to poor surface finish in machining operation. (5%)