機械製造 (50 分)

1. In what way can you increase the strength of a pure material?(5%)

2. When a design engineer realized a machine component was failure frequently by fracture, he/she decided to replace it with another component of a material with a higher strength, with the thickness increased. Was this is a good idea? Explain. (5%)

3. A steel rod is to be turned on a lathe from 2.9 in. diameter to 2.5 in. diameter for a length of 8 in.. Machinability study shows that for this carbide-work combination, the following relationships are valid.

$$V = 6t^{-0.2}f^{-0.7}d^{-0.4}$$
$$F_c = 250,000\, f^{0.9}d^{0.6}$$

(F_c = cutting force in lbf, V = cutting speed in ft/min, t = tool life in minutes, f = feed in inch per revolution, and d = depth of cut in inches.

(a) Find the constants n and C in the Taylor tool life equation for a feed of 0.015 inch per revolution. (5%)

(b) In order to use the carbide tool for 30 minutes, and to maintain the above machining conditions, what capacity of lathe in terms of horsepower would you recommend? (5%)

4. Calculate the energy required to punch a 2 mm diameter hole in a 1/2 mm thick plate of hot rolled structural steel ($Y = 600$ MPa). (5%)

5. For wire drawing and extrusion processes, which one will be restricted by the area reduction? Why? (5%)

6. Describe several typical methods of manufacturing small (e.g. 1/2 in. diameter x 3 in. long) threaded steel bolts from bar stock. Bearing in mind economic considerations underlying choice of material, the effect of the process on the material, and the final strength of bolt required, discuss the considerations influencing the choice of the final process. (10%)

7. Define the mechanical properties of Ductility, Hardness, Toughness, Ultimate tensile strength, Young's modulus of ductile materials. Based on the following figure, please indicate the temperature effects on these properties (10%).
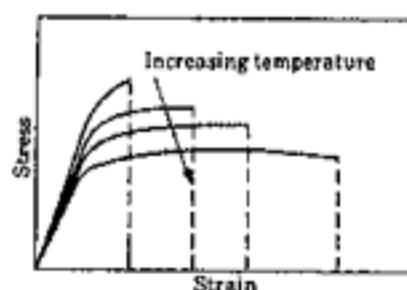
(背面仍有題目,請繼續作答)

[1999 成大機研 碩士班入學考試 － 機械材料試題(50分) -]

*_ 題目較多，時間有限，請注意把握時間，扼要作答。_

一. 名詞解釋或簡答 (每題2分，共10分)

    1. 硬度

    2. 相律(Phase rule)

    3. A_{c1}, A_{c3}, A_{cm} 變態點

    4. 再結晶

    5. 六方最密堆積(HCP)與FCC有相同之APF，其結構上主要不同何在？

二. 問答 (每題4分，共32分)

  1. 請比較金屬、陶瓷、高分子材料在特性上有何主要不同？

  2. 如何決定晶粒之大小？

  3. 如何決定材料之降伏強度？

  4. 影響替代式固溶之固溶度大小之因素有那些？

  5. 請說明同材質料但尺寸大小不同的試件，拉伸試驗所得之強度是否一樣？

  6. Fe-C平衡圖上之共析及共晶反應點何在？反應式為何？

  7. 鑄件凝固後所常見的缺陷有那些？

  8. 金屬材料具有超塑性的條件為何？

三: 計算題 (8 分)

一個屬於立方晶系之金屬粉末試件，利用銅靶所產生之 X 光做繞射分析，量測結果，分光儀(Diffractometer)記錄器上所得繞射峰(Peaks)所在位置的角度分別為：38.6°, 44.8°, 65.3°, 與 78.5° 時，X 光之波長 $\lambda_{Cu-K\alpha}$ = 0.1542 nm ，請問

    1: 金屬試件之晶格常數！又如何得知(證明)其為定值(Constant).

    2: 相對各個繞射峰之晶格平面的密勒指標，又該金屬為何種晶体結構.

(*: 對 BCC: 當 h+k+l=偶數，對 FCC: 當 h,k,l 皆為偶數，或皆為奇時，繞射強度 I 不等於零.)