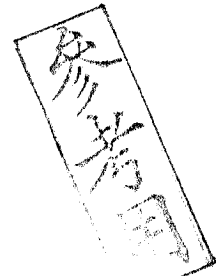


系所別: 機械工程學系 乙組 科目: 機械材料及材料力學

A. 機械材料(50%)

一、請回答下列問題：(25%)

(1) 水的三相點(Triple Point)發生於 0.007atm 與 0.0075 °C，請利用上述

數據與日常生活知識，繪製水的一元相圖(Unary Phase Diagram)。

(10%)

(2) 為何低碳鋼進行滲碳處理時，要在沃斯田鐵(Austenite)狀態下進

行，而不在肥粒鐵(Ferrite)狀態下進行？(5%)

(3) 鋁合金在室溫下，可長時間暴露於大氣環境中，而不會有腐蝕發生。

為什麼？(5%)

(4) 304 不銹鋼含有約 18% Cr 與 8%Ni，他們的功能是什麼？(5%)

二、Answer the questions in the following: (25%)

(1). Give a brief interpretation on the terms: (a) microelectromechanic system (MEMS); (b) thermal shock; (c) copolymer; (d) crevice corrosion; (e) extrinsic semiconductors. (2% x 5 = 10 %).

(2). The tensile test usually used in strength estimation of the metallic materials is not applicable to ceramic materials, why? (5%) Suggest a suitable strength test for the ceramic materials, and give a brief interpretation on this technique. (5%)

(3). Give a typical plot of B-versus-H for a ferromagnetic material that was initially un-magnetized. Domain configurations during several stages of magnetization should be represented. Saturation flux density (B_s), magnetization (M_s), and initial permeability (μ_i) should also be indicated in this plot. (5%).

注意：背面有試題

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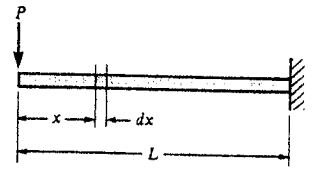
B. 材料力學(50%)

三、A cantilever beam of length L and rectangular cross section (width b , height h)

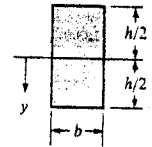
carries a concentrated load P at the free end (see figure 3). The stress-strain curve of the material in tension is represented by the equation $\sigma = B\sqrt{\epsilon}$, where B is a constant; the curve has the same shape in compression.

Determine: (a) strain energy for this beam. (15%)

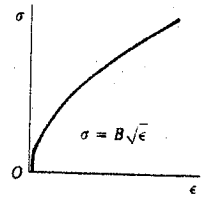
(b) complementary energy for this beam. (10%)



(a)



(b)



(c)

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Figure 3 Cantilever beam with material nonlinearity

四、(25%)

- (1) The shear-force diagram for a beam is shown in the Fig. 1. Assuming that no couples act as loads on the beam, draw the bending-moment diagram. (Note that the shear force has units of kilonewtons.) (10%)
- (2) A circle of diameter $d = 8$ in. is etched on an unstressed brass plate (see Fig. 2). The plate is square with dimensions 16 in. x 16 in. x 0.5 in. Later, forces are applied that produce uniformly distributed normal stresses $\sigma_x = 6000$ psi and $\sigma_y = 2000$ psi along the edges of the plate. Calculate the following quantities: (a) the change in length Δac of diameter ac ; (b) the change in length Δbd of diameter bd ; (c) the change Δt in thickness of the plate; (d) the dilatation e ; and (e) the total strain energy U stored in the plate. (Assume $E = 15 \times 10^6$ psi and $\nu = 0.34$.) (15%)

Fig. 1

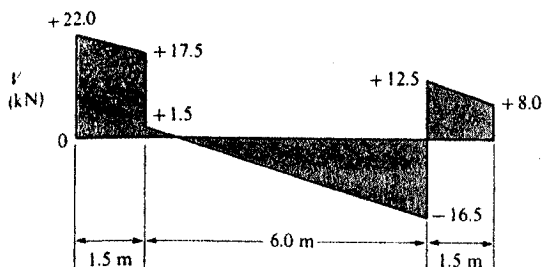


Fig. 2

