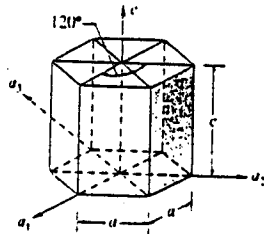


Part I.

機械材料試題

1. 下圖為一HCP (hexagonal close-packed)結構, 請定義出各平面之米勒指數 (Miller indices) 及三個原子最密之方向, 並說明其步驟。(10%)



2. 在穩態擴散中原子之淨流量可以費克第一定律 (Fick's 1st law) $J = -DA(dC/dx)$ 來表示, 式中之 D 為擴散係數 $= a^2/6\tau$, 其中 a 為晶格常數, τ 為溶質原子停留於晶格點上之平均時間. 試證明此擴散係數在 $[100]$ 方向與 $[110]$ 方向相同, 即 $D_{100} = D_{110}$. (10%)
3. 請寫出 FCC 結構之滑移系統 (slip system), 並以原子模型證明為何滑移總發生於原子最密之方向與平面? (10%)
4. 請繪出鋼鐵之鐵碳平衡圖, 標示出各相區及變態點之位置與溫度, 並據以說明當含碳量為 0.01%, 0.8% 及 2.5% 時, 從 1550°C 降至室溫時其顯微結構隨溫度變化之情形. (10%)
5. 請繪出金屬在固定溫度及荷載下之滯變 (creep) 特性曲線, 並據以說明各階段之滯變行為及差排所扮演之角色. (10%)

Part II.

1. The length of a machining pass is 20 in. and the outside diameter of this part is 5 in. The velocity and feed for this material are 275 ft/min and 0.02 in. per revolution. (a) Determine the spindle rpm of this lathe (4%) (b) Find the uncut chip area A_c if the back engagement is 0.05 in (4%) (c) Calculate the material rate Z_w (4%) (d) What is the time in seconds to machine ? (3%)

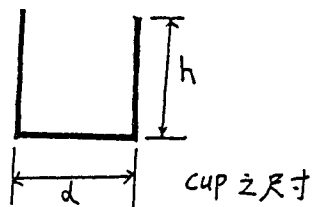
2.

(a) List eight broad categories of forming processes (manufacturing processes without cutting chips) and describe them briefly with figures (10%)

(b) If 40% weight of a cast is sprues, gates, and risers, how much aluminum must be melted per day to produce 350 finished castings weighing 1.9 kg each ? (4%)

3. Estimate the radius of blank required to produce a cup by deep drawing (4%)

(素材)



4. In drilling operation using the twist drill, the rotational frequency of a drill is 5 s^{-1} , the feed is 0.25 mm, the major cutting edge angle is 60° , and the drill diameter 12 mm. Assuming that the specific cutting energy for the work material is $2 \times 10^9 \text{ J/m}^3$, calculate

(a) The maximum metal-removal rate, in $\mu\text{m}^3/\text{s}$ (3%)

(b) The undeformed chip thickness, in millimetres(3%)

(c) The undeformed chip length, in millimetres(3%)

(d) the power required (3%)

(e) the drill torque in netton-metres(5%)

