國立中央大學九十一學年度碩士班研究生入學試題卷

所別: 機械工程學系 乙組 科目: 機械材料及材料力學 共 2 頁 第 1 頁

一.25%

(1) Show that the atomic packing factor for(10%)
(a)Body Center Cubic is 0.68
(b)Face Center Cubic is 0.74

(2) What is the chief difference between (15%)
(a)heat-treatable and nonheat-treatable alloys?
(b)natural aging and artificial aging processes?
(c)isothermal transformation diagram and continuous cooling transformation diagram?
(d)spheroidite and tempered martensite structures?
(e)hardness and hardenability?

二、25%

(1) Sketch the specific volume as a function of temperature, upon cooling from the liquid melt, for amorphous (as curve A), semicrystalline (as curve B) and crystalline (as curve C) materials. (6%). Point out the melting point(Tm)and glass transition temperature (Tg) in this scheme. (4%)

(2) Briefly interpret the following terms, with an aid of equations or examples. (15%)
(a) Galvanic series that is useful in corrosion. (3%)
(b) Schottky defect that exists in a ceramic material. (3%)
(c) Electron mobility for a conducting material. (3%)
(d) Magnetic susceptibility of a magnetic material. (3%)
(e) Sketch an energy diagram for the Ruby laser, showing electron excitation and decay path. (3%)

三. 25%

(1) Calculate the deflections δ_b and δ_c at points B and C, respectively, of the cantilever beam ACB shown in Fig. 1. Assume M_0 = 35 in.-kip, P = 3.6 kip, L = 8 ft, and EI = 2.1 x 10^7 lb-in.^{2} (12%)

(2) Determine the shear stress at points B and C on the web of the beam located at section a-a shown in Fig. 2. (8%)

(3) Determine the maximum shear stress acting at section a-a in the beam shown in Fig. 2. (5%)

Fig. 1

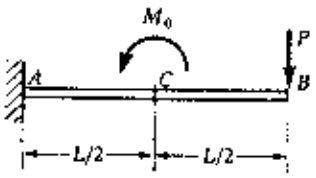
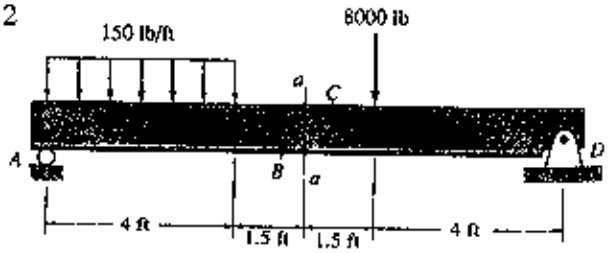
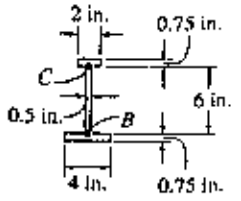


Fig. 2





注意:背面有試題

四、27%

(1) In general, fine grain could improve mechanical properties. By using ECAE (Equal Channel Angular Extrusion), material could obtain fine-grained microstructure. ECAE is a process involving pushing a work piece through two channels of equal cross section that meet at an included angle Φ (Fig. 3). This process causes large strain in the material. Assume that in ECAE process the particles in the material move in the same velocity.

(a) What is the strain for the case described in Fig. 4. (5%)

(b) What is the strain for the case described in Fig. 5. (5%)

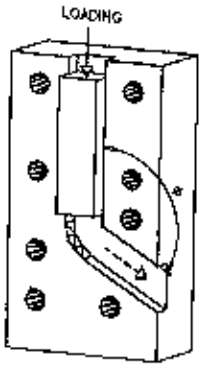


Fig. 3

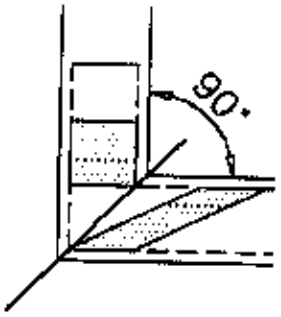


Fig. 4

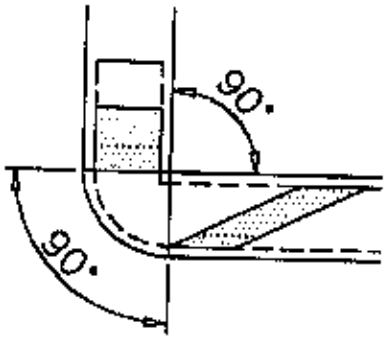


Fig. 5

(2) The two shafts are made of A-36 steel. Each has a diameter of 25mm and they are connected using the gears fixed to their ends. Their other ends are attached to fixed supports at A and B. They are also supported by bearing at C and D, which allow free rotation of the shafts along their axes. If a torque of 500 N · m is applied to the gear E as shown in Fig. 6.

(a). Determine the reactions at A and B.(10%)

(b). Determine the rotation of gear at E. Take G_{st}= 75 GPa (5%)

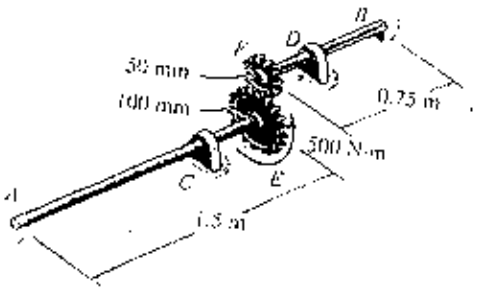


Fig. 6

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