

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

1. (a) How is the Brinell hardness number of a material related to its yield or tensile strength? Why does such a relationship exist? (5%)
 (b) What are the major factors to be considered when choosing one type of hardness test over the other? (5%)
2. (a) Describe two types of casting processes which use expendable mold and permanent pattern. (5%)
 (b) Describe two types of casting processes which use expendable mold and expendable pattern. (5%)
3. Describe two types of bulk deformation process. Illustrate these processes with drawing and identify key process parameters. (10%)
4. An orthogonal cutting operation is being carried out for a material with the following parameters: depth of cut: 0.05 mm, width of cut: 6 mm, cutting speed: 200 m/min, tool rake angle: 10°. It is observed that the chip thickness is 0.09 mm; the cutting force and thrust force are 600 N and 240 N respectively. (a) What is the work material's specific cutting energy for this process? (5%) (b) Calculate the percentage of the total energy that is dissipated in friction at the tool-chip interface. Assuming that friction exists only at the tool-chip interface. (15%)
5. Explain or distinguish the following terms: (a) amorphous vs. crystalline, (b) true stress vs. true strain, (c) toughness vs. resilience, and (d) mechanical twin vs. annealing twin (16%)
6. (a) Briefly explain why some metals (e.g., Pb and Sn) do not strain harden when deformed at room temperature. (4%)
 (b) Would you expect it to be possible for ceramic materials to experience recrystallization? Why or why not? (6%)
7. Following fracture of a steel bar tested in tension and having an initial gage length of 50 mm and diameter of 12.8 mm, the final gage length and diameter are found to be 63 mm and 7.6 mm, respectively. Calculate (a) percent elongation, (3%) (b) percent reduction in area, (3%) and (c) true fracture strain. (4%)
8. Below is the Fe-Fe₃C phase diagram, please answer the following questions.
 - (a) What is the pearlite microstructure? What is difference between the coarse and fine pearlites? (6%)
 - (b) Compute the mass fractions of α ferrite and cementite in pearlite. (4%)
 - (c) What is the proeutectoid phase for an iron-carbon alloy in which the mass fractions of total ferrite and total cementite are 0.86 and 0.14, respectively? Why? (4%)

