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THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
BACHELOR OF TECHNOLOGY – LEVEL 5
FINAL EXAMINATION – 2010/11

MEX 5272 – MATERIALS & MANUFACTURING TECHNOLOGY
DATE : 31ST MARCH 2011
TIME : 1400-1700 HRS
DURATION : 3 HOURS

ANSWER (05) QUESTIONS ONLY. ALL QUESTIONS CARRY EQUAL MARKS.

1. (a) Briefly explain the difference between Hardness and Hardenability.

   (b) What are the effects of various alloying elements in steel?

   (c) Determine the radial hardness profile for a 75mm diameter cylindrical specimen of 5140 steel that has been quenched in moderately agitated water. Refer Fig.1 & Fig. 2 given below to find the equivalent distances from the quench end and the corresponding HRC values.

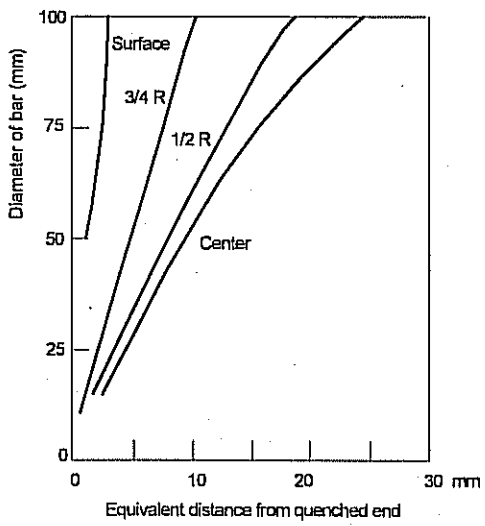


Fig. 1

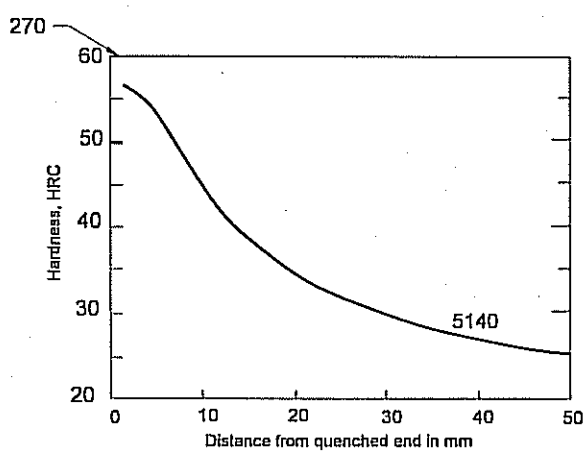


Fig. 2

2. (a) What is cast iron?
   Compare and contrast gray cast iron and nodular cast iron.

   (b) Describe the main advantages of using cast iron over steel.

   (c) Write down the differences between Thermoplastics and Thermosetting plastics.

3. (a) Define the terms "Phase" and an "Equilibrium phase diagram" in materials.

(b)

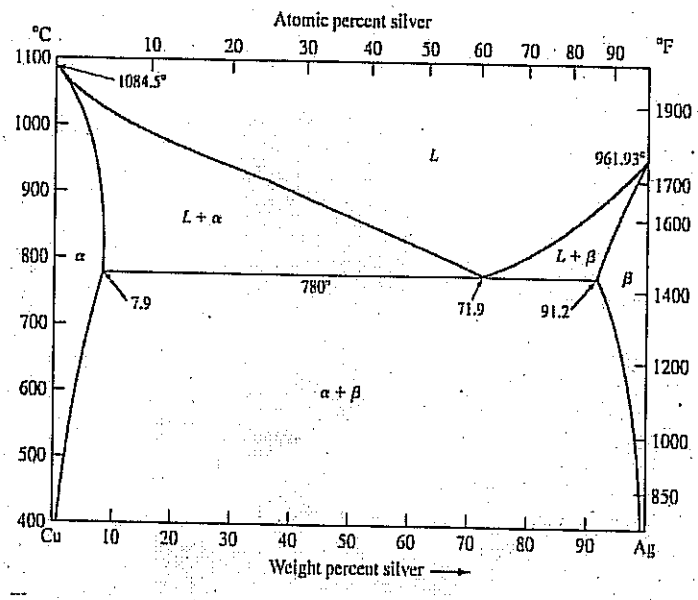


Fig. 3

Shown in Fig.3 above is the Binary Eutectic Copper-Silver phase diagram. Consider an alloy containing 88wt% Ag and 12wt% Cu, and answer the following.

(i) Make phase analysis when cooling from 1000° C to 500°C.

(ii) Calculate the amount of liquid and β phase present at 800°C.

(iii) Sketch the microstructure at 800°C using circular microscopic field.

4. (a) Explain the three main areas in metrology.

(b) Giving suitable examples, explain the types of measurement errors encountered when taking measurements. How would you propose to eliminate or minimize these errors?

(c) *A precise instrument may not necessarily produce accurate measurements.* Comment on the statement with regard to measuring instruments.

5. (a) Briefly explain at least three types of mechanisms in which tool wear occurs in cutting tools.

   (b) Explain with the aid of a neat sketch, crater wear and flank wear in the context of tool wear during machining. Why flank wear is considered a good measure of predicting tool life?

   (c) A carbide tool was found to give a life of 2 hours when machining a piece of mild steel at 50 m/min. Calculate the tool life, if the same loading conditions are used at a speed, 30% higher than the previous speed. Also determine the cutting speed if the tool is required to have a tool life of 3 hours. Assume cutting tool index n as 0.25. (Taylor's tool life relation is given by $VT^n = C$, where V - cutting speed, T - tool life, n – cutting tool index and C –constant)

6. (a) Briefly explain the principle of friction welding. Distinguish between continuous drive type friction welding and inertia friction welding processes.

   (b) Explain what is meant by weldability. What are the factors affecting weldability?

   (c) Why are defects in weld profile often considered a useful indication in assessing weld quality? Name and briefly explain the common defects in weld profiles.

7. (a) What is the significance of strain hardening in relation to metal forming processes? Briefly explain the behaviour of flow stress during a cold working process.

   (b) Discuss at least three independent and dependant variables considered in metal forming processes.

   (c) What are the advantages and disadvantages of cold working as compared to hot working of metals? State at least five each of such advantages and disadvantages.

8. (a) Briefly discuss the six basic requirements associated with most of the casting processes.

   (b) Explain the importance of fluidity in casting processes.

   (c) Discuss the types of modifications or allowances that are incorporated in making patterns for castings

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