

COLLEGE OF ENGINEERING, PUNE – 5
(An Autonomous Institute of Government of Maharashtra)

End Semester Examination
MT 433 – Wire Technology

Programme: **B.Tech. (Metallurgical Engineering)**

Duration: **3 Hours**

Max. Marks: **50**

Year: **2011-12**

Date: **5 May 2012**

Instructions:

- 1) Answer all questions.
- 2) Draw neat figures wherever required.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if required.

Q.1 (a) State the purposes of heat treating steel wires for different applications.5

(b) A tire cord wire of 0.2 mm diameter is to be produced from 5.5 mm diameter wire rod. Draw a schematic process chart for its production including in line heat treatment and post processing. Suggest the parameters to be controlled for achieving high strength in the final product.5

(c) What are the process control parameters for achieving correct microstructure and strength in a steel wire after patenting heat treatment? State different alternatives to lead bath for patenting.5

Q.2 (a) 'Strain Ratio' (SR) is defined as ratio A_0/A_f , where A_0 is original cross section area and A_f is final cross section area of wire. Derive the expression for % reduction in area (R) and initial diameter (d_0) when final diameter of wire is d_f .

Calculate a 3-die, uniform reduction per pass drafting schedule starting with 4.50 mm wire rod and ending with 3.3 mm wire.6

(b) What are the reasons of 'center-burst' of 'chevron formation' occurring during wire drawing?2

(c) It is suggested that the approach zone length (L) should be about twice that of the actual deformation zone (l). Why?2

(d) State the von Mises' criterion for effective stress (σ_{eff}) for yielding to occur under multi-axial stress conditions. For the same criterion, how are the yield strengths in pure shear (τ_y) and pure tension (σ_y) related?3

(e) State the Siebel's formula for drawing force during wire drawing.2

- Q.3 (a) Write Short notes on any two of the following
1. 'G-casting' process
 2. Carrier Coatings of wire rods
 3. Model and parameters for reducing lamellar spacing (S) in pearlite
-5
- (b) Draw self explanatory figures of any two of the following
1. Single Block Double Decker Wire Drawing Machine
 2. Problems that occur with dry lubrication during wire drawing
 3. Direct water spray cooling block
 4. TTT diagrams for hypo-eutectoid and hypereutectoid steels
-5
- (c) Compare the properties and conditions of using the calcium-stearate and sodium-stearate dry lubricants.
-5
- (d) What do mean by 'scale' on a wire rod? State the differences between pickling with hydrochloric acid (HCl) and sulfuric acid (H₂SO₄).
-5

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COLLEGE OF ENGINEERING, PUNE
END SEMESTER EXAM
Fracture mechanics and Material Joining
B. Tech (SAND, Metallurgy)

Year: 2011-12

Duration: 3 hours

Date: 12 /05/12

Max.Marks: 50

Instructions:

- 1) Answer all the questions.
- 2) Figures to the right indicate full marks.
- 3) Draw neat figures wherever required.

- Q.1** a) With the help of neat sketches describe *any two* of the following joining process. State its process parameters, advantages and applications:
- i. Diffusion welding
 - ii. Thermit welding
 - iii. Friction stir welding
- b) What are the basic molten metal transfer modes in GMAW? --6
- c) Define heat source efficiency. --2
- Q.2** a) State the assumptions used by Rosenthal to derive analytical equations for heat flow during welding. State the Rosenthal's three-dimensional equation and the meaning of each term in the equation. -- 4
- b) Answer *any two* the following: -- 6
- i. What is the main reason of distortion in weldments? What are the types of distortion possible and explain any one.
 - ii. What are the types of fluxes used in welding? What is basicity Index? Do you prefer using an oxidizing or reducing flame in gas welding of high carbon steels? Why or why not?
 - iii. Explain the Epitaxial growth pattern found in fusion weld zone.
- Q.3** a) What are the differences and their effects between casting and welding solidification? --4
- b) In which alloys do the following welding problems occur? Explain them and give its cause and remedies: (any two) --6
- i. Knife line attack
 - ii. Hydrogen cracking
 - iii. Solidification cracking
- Q.4** a) How fracture toughness can be experimentally determined. ---6
- b) State the difference between designing machine components on the basis of strength of materials approach and fracture mechanics approach. --4
- Q.5.** a) Explain the terms: critical strain energy release rate and plain strain fracture toughness. --6
- b) Show the effect of specimen thickness on the stress intensity factor and explain

(MT 411) Ceramic Engineering

Time: 3 Hours]

Instructions to candidates:

[Max. Marks: 100

- 1) All Question are compulsory.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of non-programmable electronic pocket calculator is permitted.

- Q. 1 Give to the point answers (any five): [10]
- (a) What is the purpose of adding oxide dopants such as Y_2O_3 , CeO_2 or MgO to zirconia?
 - (b) What do you understand by transformation toughening of zirconia?
 - (c) Can the fracture toughness be estimated using microhardness tester?
 - (d) Compare the fracture toughness values of metals, ceramics and polymers.
 - (e) What is the necessary condition for densification to occur?
 - (f) What types of changes are likely to occur in ceramics during sintering?
 - (g) What is Weibull modulus?
- Q. 2 (a) Discuss the various strengthening and toughening mechanisms useful in the design of creep resistant ceramics. [5]
- (b) Write possible defect reactions and corresponding mass action expressions when possible for (any 5): [5]
- (i) Oxygen from atmosphere going interstitial
 - (ii) Schottky defect in M_2O_3
 - (iii) Metal loss from ZnO
 - (iv) Frenkel defect in Al_2O_3
 - (v) Dissolution of MgO in Al_2O_3
 - (vi) Dissolution of Li_2O in NiO
- Q. 3 Write the principles and mechanisms involved in the manufacturing of ceramic powders by following methods (any 02): [10]
- i. Sol-gel method
 - ii. Precipitation method
 - iii. Hydrothermal synthesis
- Q.4 (a) Discuss the role played by various oxide additives used in glass manufacturing. [5]
- (b) What is slip casting? Discuss the important processing parameters involved therein. [5]
- Q.5 Solve any 2 of the following:
- (a) Illustrate the three main stages of sintering. [5]
 - (b) Discuss the various mechanisms by which grain growth occurs during sintering. [5]
 - (c) Discuss the mechanism of sintering of alumina with/without sintering aid. [5]

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End-Semester Examination (2011-12)

B.Tech. (Metallurgy)

MT 424: Surface Modification

Date: 5th May 2012

Time allowed: 3 hrs

Max. Marks: 50

Instructions to students:

- i) There are no sections. ii) Numbers to the right indicates full marks.
iii) Draw sketches wherever necessary. iv) All questions are compulsory.
v) Exchange of calculator not allowed.

Marks

- Q.1 What is Chemical Vapor Deposition (CVD)? Compare Thermal CVD and plasma CVD. 10
- Q.2 Discuss suitable surface treatment (s) for an automobile piston ring (s). 10
- Q.3 What is the role of aluminum in zinc coating? Discuss with suitable example how the surface properties vary with aluminum content in zinc coating? 10
- Q.4 Consider the gas carburizing of a gear of AISI 1020 steel at 927°C. Calculate time in minutes necessary to increase the carbon content to 0.40% at 0.5 mm below the surface. Assume that the carbon content at the surface is 0.90% and that the steel has a nominal carbon content of 0.20%. ($D_{927^\circ\text{C}} = 1.28 \times 10^{-11} \text{ m}^2/\text{s}$).

Erf Z	Z
0.7112	0.75
0.7143	x
0.7421	0.80

- Q.5 a) A silicon wafer with a series of windows in an oxide layer is undergoing ion implantation with a beam of boron ions at 100 keV. If the beam dose is $3.0 \times 10^{15} \text{ cm}^{-2}$ and projected straggle range is 900 Å, what is the peak concentration of the boron ions at the projected range? 5
- b) Discuss semiconductor lasers. 5

--End--

All the best