

BACHELOR OF METALLURGICAL ENGG. EXAMINATION 2009

(4th Year, 2nd Semester)

METAL JOINING AND POWDER METALLURGY

Time : Three hours

Full Marks : 100
(50 marks for each part)

Use a separate Answer-Script for each part.

PART-I

Answer Question No. 1 and any **two** from the rest.

1. State whether the following statements are true (T). or false (F) and explain why ? 20
- a) Among the arc welding processes, GTAW process gives best weld quality.
 - b) The groove angle for stainless steel can be narrow compared to mild steel.
 - c) Most GMAW is performed with DCRP for deep penetration.
 - d) For welding of aluminium using GTAW process, AC is preferred.
 - e) Micro-segregation is more pronounced in welding than casting.
 - f) Basic coated electrodes are preferred for low hydrogen and low sulphur content in weld metal.

[Turn Over]

(2)

- g) Soldering is extensively used in Electronic industries.
 - h) Flux related process always enjoys some merits.
 - i) Laser beam welding is less efficient than conventional arc welding process.
 - j) Free energy formation of any metal oxide provides reliable information for producing defect free weld.
2. Why drooping type power source characteristics is preferred for MMAW process and flat type is preferred for GMAW process ? What do you mean by 'Duty Cycle'? How with you make a continuous welding with a power source whose duty cycles is 60% at rated current of 300 amps? Inverter type of power source is the order of the day – comment. 15
3. Discuss how one can establish weld procedure for a given steel using fusion welding process without trial and error. How technical characteristics of laser weld differ from conventional arc weld? State the merits & demerits between between CO₂ laser and YAG laser. 15
4. Why solid-state welding is preferred over fusion welding in case of dissimilar metals & alloys? Why a threshold deformation is required before the joints develop any strength? Discuss a suitable method of Joining Aluminium based metal matrix composite. 15

(5)

9. What are the major functions of the Compaction of metal powders ? Discuss the different Compaction techniques in brief. 15
10. a) Mention the chief phenomena occurring in the sintering of pressed powders.
- b) Explain how sintering of process is related to the changes in the interparticle Contacts. 15

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(4)

- g) Discuss the role of powder metallurgy in nuclear applications. 5x4 =20
7. a) Show Schematically the basic steps in powder metallurgy process.
- b) Discuss the principles of production of metal powders.
- c) Describe a process use for the production of Carbonyl nickel powder. 15
8. a) What are tungsten Carbide inserts? Where is it used? How is it made? Draw the typical microstructure of such an insert.
- b) A Cemented Carbide Cutting tool used for machining Contains 75% Wt%/Wc, 15% Tic, 5% Wt% Tac and 5% CO.; Estimate the density of the composite Given $\rho_{wc} = 15.77 \text{ gm/cm}^3$ $\rho_{Tic} = 4.948 \text{ gm/cm}^3$ $\rho_{Tac} = 14.5 \text{ gm/cm}^3$ $\rho_{CO} = 8.908 \text{ gm/cm}^3$.
- c) A silver tungsten Composite for an electric contact is produced by first making a porous tungsten powder metallurgy. Compact, then infiltrating pure silver into the pores. The density of tungsten compact before infiltration is 14.5 gm/cm^3 . Calculate the volume fraction of porosity and the final weight percent of silver in the compact after infiltration.
- Given : Density of pure tungsten = 19.3 gm/cm^3 .
Density of pure silver = 10.49 gm/cm^3 .

(3)

5. Why the inclusion content is considered as one of the major factors controlling the microstructure of weld metal. Now a days, HAZ cracking due to hydrogen is less severe than weld metal cracking– explain. Discuss the possible ways of minimizing hydrogen induced cracking. 15

PART–II

Answer Question No. 6 and any **two** from the rest.

6. Answer any **four** of the following.
- a) Most metals and alloys can be processed using the melting and casting route, but we do not prefer to apply this method for the processing of specific metals (e.g.w) and most ceramics. Explain.
- b) What is meant by liquid phase sintering? How does the liquid phase form? What happens to the liquid phase after sintering is completed ?
- c) What are hot pressing arc hot isostatic pressing ? Mention the specific advantages of using them compared to using normal sintering ?
- d) What is CERATIZIT ? What does it do?
- e) List the common methods of particle size determination and their limits of applicability.
- f) Give three major attributes of powder metallurgy processing.

[Turn Over]