

Code No: 07A81803

R07**Set No. 2**

IV B.Tech II Semester Examinations, APRIL 2011

SUPER ALLOYS

Metallurgy And Material Technology

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. Explain the working principle of following furnaces during the melting of super alloys:
 - (a) Air arc melting practice
 - (b) Vacuum induction melting. [8+8]
2. Explain various practical cast methods for controlling cast structure. [16]
3. (a) Discuss the fracture properties of super alloys.
 (b) Explain about pack - cementation process of coatings on super alloys. [12+4]
4. (a) Which industry is the largest user of superalloys? Why? Explain.
 (b) Explain how the wider use of different varieties of super alloys in air craft gas turbines increased engine performance drastically.
 (c) Discuss the important mechanical properties of super alloys in general. [5+6+5]
5. Write an essay on the progress and development of superalloys. Giving the composition microstructure, properties and uses appropriately. [16]
6. (a) What are the various types of heat treatment methods? Explain the principle of each one of them in detail.
 (b) What is visual test method to find out micro & macro defects of super alloy products? Explain in detail the visual test method. [8+8]
7. (a) What is the important reason for possessing the high temperature strength for majority of the super alloys? Discuss.
 (b) Distinguish between
 - i. Precipitation strengthening and solid solution hardening.
 (c) Which phases are responsible for strengthening in cobalt base super alloys and nickel base super alloys? Also explain between the two alloys which is stronger & why? Discuss. [6+6+4]
8. What is mechanical alloying? Why is it done? Explain mechanical alloying process to produce super alloy products. [16]

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R07**Set No. 4**

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SUPER ALLOYS

Metallurgy And Material Technology

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

1. What are stainless steels? Give typical composition, properties and applications, of all types of stainless steels. Why these steels are stainless? Explain. [16]
2. What do you mean by thermomechanical processing? Explain in detail. What are the advantages? Which super alloys are subjected to thermomechanical treatment? Discuss in detail. [16]
3. Explain the various methods available for degassing the dissolved gases from the molten super alloys. [16]
4. (a) Discuss in detail the typical heat treatment procedures adopted to wrought super alloys so as to stabilize the structure sufficiently to produce optimized long time rupture properties.
(b) What are the advantages and limitations of visual test method? Discuss. [10+6]
5. Write an essay on the basic components of the compacting tools for compacting super alloy powders. [16]
6. (a) Give the major areas, where super alloys are widely used. Explain why the super alloys are used for those applications.
(b) For which components of gas turbine engine, super alloys are widely used. What group of super alloys are used. Give their composition & properties. [8+8]
7. (a) Explain, how the cobalt base alloys and Nickel base super alloys can be strengthened.
(b) Explain the creep behavior of Inconel-700 & M-252 at elevated temperatures and how does it lead to fracture. [8+8]
8. What are the various methods available to produce single crystals? Explain any two of the methods in detail. [16]

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R07**Set No. 1**

IV B.Tech II Semester Examinations, APRIL 2011

SUPER ALLOYS**Metallurgy And Material Technology****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions****All Questions carry equal marks**

1. (a) Explain the main aims of heat treatment.
(b) What are the important non-destructive test methods to evaluate the quality of super alloy products? Explain the working principle of them. [6+10]
2. Discuss in detail about:
 - (a) Ferritic
 - (b) Austenitic and martensitic stainless steels with respect to microstructure, properties and applications. [16]
3. (a) What is investment casting? Explain the principle of investment casting in detail with relevant sketches.
(b) Describe the various steps involved in the investment casting process for the manufacture of near net shape super alloy cast parts. [8+8]
4. (a) What should be the properties expected for a material to be used to produce turbine disks? Which super alloy is ideally suited for such application? Explain why?
(b) Describe the sequence of operations and production process selected to produce turbine disks made of super alloys. [8+8]
5. (a) Draw the microstructure of 901 alloy which is heated below γ' and η solvus temperature and aged. Label the phases and explain the microstructures.
(b) Define and explain cold working; and hot working. [10+6]
6. What are second phase precipitates? What are the properties contributed to the super alloys by the second phase precipitates? Whether any non-metallic inclusions such as oxide particles be the useful constituents in such alloys? Explain. [16]
7. (a) What are the various Ferro alloys used in vacuum melting of super alloys? Discuss about them.
(b) Discuss about the refractory lining used in the furnaces which melt super alloys. Discuss the advantages of each type of refractory. [8+8]
8. (a) In to how many groups Iron base casting super alloys are divided? Name them and explain about them.
(b) Give the composition, properties and applications of S-816, wrought cobalt base alloy. [6+10]

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R07**Set No. 3****IV B.Tech II Semester Examinations, APRIL 2011****SUPER ALLOYS****Metallurgy And Material Technology****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions****All Questions carry equal marks**

1. (a) What is powder metallurgy? What are the advantages and limitations of powder metallurgy?
(b) What factors must to be considered for the forging of super alloy rotor parts? Explain in detail. [8+8]
2. What is surface degradation? What are the various potential forms of degradation? Explain all of them in detail. [16]
3. (a) Explain the effect of Argon degassing prior to vacuum induction melting on the microstructure of Ni-base super alloys.
(b) What are various types of secondary melting techniques? Explain the working principle of any one of the techniques. [6+10]
4. What are the materials which are commonly used for electrical resistance purpose. Name the important Iron base casting alloys used for this purpose. Give their composition, properties and applications. [16]
5. (a) What is degassing? What is the necessity of degassing during melting practice? Discuss in detail?
(b) What are the various gases soluble in molten super alloys? What are the harmful effects of these dissolved gases on the properties of super alloys? [8+8]
6. (a) Distinguish between X-ray radiography and gamma-ray radiography of NDT to evaluate the quality of super alloys.
(b) What are ultrasonic waves? How are they produced? Discuss. [8+8]
7. (a) Distinguish between short freezing range alloys and long freezing range alloys. Give also suitable examples for the above.
(b) Discuss how the performance of turbine blades made of super alloys improved by controlled solidification. [8+8]
8. (a) Compare and contrast:
 - i. Crucible test and
 - ii. Electro-chemical test, which are used to study hot corrosion of super alloys.
 (b) Explain about 'slurry spraying' method of coating on super alloys. [12+4]
