

# SYED AMMAL ENGINEERING COLLEGE

(Approved by the AICTE, New Delhi, Govt. of Tamilnadu and Affiliated to Anna University, Chennai)

Established in 1998 - An ISO 9001:2008 Certified Institution

Dr. E.M.Abdullah Campus, Ramanathapuram – 623 502.

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## 1. Define Solid solution

Two metals combined together to form a single structure

## 2. Name the two kinds of Solid Solutions

Substitutional  
Interstitial

## 3. How the substitutional Solutions are formed.

When the Solute atoms replace Solvent atoms

## 4. How the Interstitial Solutions are formed.

When the Solute atoms are small enough to occupy the holes between the Solvent atoms

## 5. What are the factors governing Solid solubility?

Crystal structure  
Relative atomic  
size Chemical  
affinity Valency

## 6. What is Phase diagram?

The phase diagram indicates the temperature at which the solid alloy will start melting and finish melting.

## 7. What are the types of phase diagrams?

Unary  
Binary  
Ternary

## 8. What are the Coordinates of phase diagram?

Temperature and Time

## 9. What is Isomorphous Reactions?

Two metals that is completely soluble in Liquid state and solid state.

## 10. Give some examples of Isomorphous alloy systems.

Copper and  
nickel Gold  
and silver Iron  
and vanadium

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11. What is Eutectic Reactions?

Two metals that are completely soluble in Liquid state and partly or insoluble in the solid state

12. Give the Reaction happening in Eutectic?

Liquid  $\rightarrow$  Solid 1 + Solid 2

13. What is Peritectic Reactions?

Liquid + Solid 1  $\rightarrow$  Solid 2

14. What is Eutectoid Reactions?

This reaction is due to the transformation in solid state

15. Give the Reaction taking place in Eutectoid?

Solid 1  $\rightarrow$  Solid 2 + Solid 3

16. Write an example of the eutectoid reaction occurs in the Iron Carbon System

Austenite  $\rightarrow$  Ferrite + Cementite

17. What is Peritectoid Reactions?

This reactions is due to the transformation of two Solids in to third solid state

18. Give the Reaction taking place in Peritectoid ?

Solid 1 + Solid 2  $\rightarrow$  Solid 3

19. Why Iron-Iron Carbide diagram is important/

It is the most important binary alloy system in engineering alloys because we get important alloys Cast Iron and steel.

20. What is the content of steel?

It contains 0.008% to 2.14 wt% C in Fe.

21. What is the content of Cast Iron?

It contains 2.14% to 6.7 wt% C in Fe.

22. What are the two-phase diagrams of Iron-carbon system?

Fe – Fe<sub>3</sub> C

Fe - C

Here Fe – Fe<sub>3</sub> C is the portion of Fe – C phase diagram.

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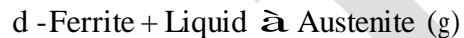
23. What are the four solid phases in the iron- iron carbide diagram?

1.  $\delta$  - Ferrite
2. Austenite (g)
3. Cementite
4.  $\alpha$  - Ferrite

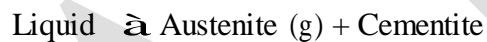
24. What are the reactions taking place in the Iron-Carbide diagram?

Peritectic  
Eutectic  
Eutectoid

25. What is the Peritectic reaction in Iron-Carbide diagram?



26. What is the Eutectic reaction in Iron-Carbide diagram?



27. What is the name of this combination Austenite (g) + Cementite?

Ledubrite

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28. What is the Eutectoid reaction in Iron-Carbide diagram?

Austenite (g)  $\rightleftharpoons$  a - Ferrite + Cementite

29. What is the name of this combination a - Ferrite + Cementite?

Pearlite

30. What is Hypoeutectoid and Hypereutectoid steel?

A composition Left to the Eutectoid Composition is Hypoeutectoid

A composition Right to the Eutectoid Composition is Hypereutectoid

31. Write the classification of steel ?

Low carbon

Medium carbon

High Carbon

Tool steel

31. How the steel classified?

According to the carbon content in Fe.

32. What are the types of Cast iron?

Gray

Nodular

White

Malleable

33. What is Heat treatment of metal?

Combination of heating, holding and cooling

34. Write some objectives of Heat treatment?

1. To Relieve internal stresses

2. To improve Machinability

3. To improve the properties

35. What are the types of heat Treatment?

Annealing

Normalising

Hardening

Tempering

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36. What are the types of Annealing?

Full

Stress-relief

Recrystallization

Spheroidizing

Process

37. What is the process in Full Annealing?

Heating the steel  $15^{\circ}$  to  $40^{\circ}$  C above  $A_3$  temperature

Now the steel is Austenized

Cooling very slowly in the furnace itself

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38. What is the process in Stress relief annealing?

Heating the steel up to 600 degree C Now the steel is Austenized  
Cooling very slowly in the room temp in air

39. What is the process in Recrystallization or process annealing?

Heating the steel 600 to 650 degree C Now the steel is Austenized  
Cooling very slowly in the room temp in air

40. What is the Spheroidizing?

The cementite is hard to machine because of its needle like structure  
So heated to about 700 degree C. Now the Cementite becomes globular structure  
Called Spheroids which will be easy to machine.

41. What is Normalising?

Annealing Heat tretment process called normalizing.  
Heating the steel  $55^{\circ}$  to  $85^{\circ}$  C above A3 temperature  
Hold for 15 minutes. Now the steel is Austenized  
Cool down in still air

42. What is the purpose of normalizing?

To refine the grain size  
To produce more uniform and desirable size distribution.

43. what is the abbreviation of TTT-diagram?

Time, Temperature and Transformation of Austenite.

44.what are the other names of TTT diagram?

Isothermal Transformation(IT-diagram) curves and S-curve,C-curve due to their shapes

45. How to obtain IT – diagram?

Normally upon cooling austenite transforms to Pearlite(ferrite + cementite)

46.what are the co-ordinates of IT-diagram?

Amount of Austenite transformed in vertical axis(Y-axis)

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Time(Logarithmic scale, so we can use for days, weeks, months) in X-axis

47. What are the products you came to know from IT-diagram?

AT 700<sup>0</sup> C Coarse Pearlite

AT 600<sup>0</sup> C upper Bainite ( Sorbite )

AT 500 to 550<sup>0</sup> C Fine Pearlite(Troosite)

AT 550 to 300<sup>0</sup> C Lower Bainite (acicular troosite)

48. What is Hardness?

Resistance to plastic deformation

49. What is Hardening?

Hardening is process in which the metal is heated to the austenizing temp and suddenly cooled in cold water.

50. What is the reason for Hardening?

Martensite is formed from Austenite directly .This is a complex structure formed due to sudden cooling.

51. What is Tempering?

In Hardening the metal becomes too brittle and with lot of internal stresses which would affect the property of metal. To remove this and to get desired property we reheat the hardened metal.this process is called Tempering.

52. What is Martempering?

If we reheat the after Martensite formation

53. What is Austempering?

Transformation directly to Bainite formation

54. What are the three types of Tempering?

Low temperature

High temperature

Medium

Temperature

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55. What are the types of hardening process?

Work  
Hardening Age  
Hardening Air  
Hardening  
Hardening by heating and quenching

56. What is Hardenability?

Penetration of Hardness in the metal

57. What is the test to find Hardenability?

Jominy Quench Test

58. What is case hardening?

The surface of the steel is more hard and wear resistant whereas the core remains soft and tough.

Example: in gears, ball bearings

59. What are the various types of case Hardening?

Carburizing, Cyaniding, Nitriding, Flame and Induction Hardening

60. What is alloy steel?

Steel in which other elements are added other than carbon.

61. What are the effects of alloying additions on steel?

To increase Strength, Hardness, Toughness, Properties

62. How stainless steel divided?

Martensitic, Ferritic, Austenitic

Plain carbon

Low alloy

High speed

High Chromium High Carbon steels

64. What is HSLA steels?

High Strength low alloy steels, which have, better mechanical properties.

65. What are Maraging steels?

Martensite aging. Steels with greater Tensile strength (ultra high strength steels)



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66. How copper alloys classified?

Copper-Zinc

Copper-Tin

67.what are the types of bronze?

Phosphorous

Silicon

Beryllium

Manganese

Aluminium

68. What are the three main steps in precipitation Strengthening treatment?

Solution Treatment

Quenching

Aging

69. Define the term polymer.

Poly- many

Mer-single unit

Polymer – many units joined together

70. What are the naturally occurring polymers?

Wood,rubber,leather etc.

71.What are the synthetic polymers?

Nylon,Terlyene,Poly ethylene ....

72. What is polymerization?

Small molecules combine to form large molecule.

73. What are the types of polymerization?

1. Addition

2. Condensation

74. What is the difference between Addition and condensation polymerization?

Addition – no by product formed

Condensation –by product formed

75.How are polymers classified?

Thermoplasts, Thermosets

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76. What is the difference between Thermoplasts and Thermosets?

Thermosets cannot be remoulded

Thermoplasts can be remoulded

77. Define ceramics?

Ceramics are compounds of metallic and non-metallic elements. Ex:  
stone,brick,clay,glass

78.What does new ceramic material include?

Oxides,carbides ,borides and other similar compounds

79. Name two refractory materials.

Magnesia

Alumina

80. What is composite material?

Two or more materials with superior properties combined together to form new product.

81. Write an example for composite material?

Cement concrete, glass reinforced plastic polywood

82. What are the different types of composites?

Particle

reinforced Fibre

reinforced

Structural

83.What is matrix and reinforcement?

The Major element molten metal is matrix.The material which is added to improve the properties is reinforcement.

84. How the metals are classified?

Ferrous (Iron-based)

Non-Ferrous (non Iron-based)

85. What are the two types of Deformation in metals?

Plastic Deformation

Elastic Deformation

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86. What is plastic deformation?

When a body is subjected to a force, it will tend to deform. When the deformation exceeds the elastic limit it will not regain to its original form

87. What is Elastic deformation?

When a body is subjected to a force, it will tend to deform. When the deformation with in the elastic limit it will regain to its original form

88. In what ways plastic deformation takes place?

Two methods

- 1.Slipping
- 2.Twinning

89. Define slipping.

It is defined as the shear transformation, which moves the atoms over a number of interatomic distances relative to their initial position.

90. Define Twinning.

It is the two plastic deformations which takes place along two planes due to set of forces acting on a given metal.