Assignment 7

Due on 2019-08-18, 22:00 IST

1. Which of the following statements are true about thermal-chemical processes?

- Better control of dimensions is possible in case of melting in case of carbonization
- Quenching of refined pitches after the treatment is needed to reduce the surface hardening
- Formation of thin layers at the surface of a steel component upon hardening is due to the reason for the surface hardening in hardened iron-based alloys
- In comparison to introduction of material carbon in nitrogen atoms, surface hardening of forged steel components can be carried out at much lower temperatures by introducing elemental elements like tantalum

No, the answer is incorrect.

Roots: A, B

2. Which of the following engineering components would benefit by being subjected to thermal-chemical surface treatments like carburizing or nitriding?

- Finished agricultural components like gearcarts and shafts
- Steel part before reaching out its measuring
- Stainless steel blades of a hydro-turbine
- Stainless steel blades of a thermal power plant operating at 750°C

No, the answer is incorrect.

Roots: C, D

3. Bonding would be preferred over nitriding in which of the following applications, (each consisting of economic and energy efficiency)?

- Stainless steel blades of a hydro-turbine
- Stainless steel blades of a thermal power plant operating at 650°C
- Dies of a paper recycling press operating at 300°C
- Dies of a hot forging press designed for steel

No, the answer is incorrect.

Roots: A, B

4. The alternate CCT curves and Altemperatures of an Fe-Cr-C alloy and an Fe-Mn-C alloy are shown in the figure below:

- The red-shade corresponds to the Fe-Mn-C alloy and the blue one to Fe-Cr-C alloy.
- One of the Fe-Cr-C alloy's higher carbon solubility due to its lower hardenability.
- The Fe-Mn-C alloy's higher carbon solubility due to its higher hardenability.
- Does not change at constant P and the Amalloy.

No, the answer is incorrect.

Roots: A, D

5. Which of the following phases can be expected to appear when quenching a nitrided metal iron in case of maintaining the parameters of a nitride (C, N) and hydrogen and ammonia gases respectively in the nitriding chamber at a temperature of 400°C? (Please refer to the table below for the diagram)

- Ferrite
- Austenite
- 0.5% steel
- 0.2% carbide

No, the answer is incorrect.

Roots: A, D

6. Solidity of a nitride iron is ferrite (solidus) which is exposed into a nitrogen gas atmosphere, below the eutectoid temperature.

- Increases with increasing temperature at constant pressure
- Increases with decreasing temperature at constant pressure
- Increases with increasing pressure at constant temperature
- Decreases with increasing pressure at constant temperature

No, the answer is incorrect.

Roots: B, C

7. Calculate the pressure at which nitrogen gas has to be maintained (if it is used as a mixing source) at 900°C as to generate a rate the same chemical potential of atoms in the nitriding atmosphere as that would be expected by a flowing ammonia-hydrogen gas mixture with their rates of 5:1 and 0:5 (in terms of hydrogen and ammonia gases respectively). at the same temperature. Equilibrium concentration for ammonia-hydrogen reaction can be described by the data given in table 5.

- 1:00 atm
- 3:00 atm
- 5:00 atm
- 7:00 atm

No, the answer is incorrect.

Roots: B, C

8. Calculate the pressure at which nitrogen gas has to be maintained (if it is used as a mixing source) at 900°C as to generate a rate the same chemical potential of atoms in the nitriding atmosphere as that would be expected by a flowing ammonia-hydrogen gas mixture with their rates of 5:1 and 0:5 (in terms of hydrogen and ammonia gases respectively). at the same temperature. Equilibrium concentration for ammonia-hydrogen reaction can be described by the data given in table 5.

- 1:00 atm
- 3:00 atm
- 5:00 atm
- 7:00 atm

No, the answer is incorrect.

Roots: B, C