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reviewer1@nptel.iitm.ac.in ▼

Courses » Advances in Welding and Joining Technologies

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Unit 7 - Week 6: Welding Metallurgy

Course outline

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Week 1: Fundamentals of Welding and Joining

Week 2: Laser and Electron Beam Welding

Week 3: Solid State Welding Processes

Week 4: Computational Welding Mechanics

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Week 6: Welding Metallurgy

Lesson 1: Welding Metallurgy Part I

Lesson 2: Welding Metallurgy Part II

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Lesson 4: Welding Metallurgy Part IV

Assignment 6

The due date for submitting this assignment has passed. **Due on 2018-03-18, 23:59 IST.**

Submitted assignment

1) Which one of the following shielding gas is suitable for welding carbon steels using GMAW process? **1 point**

- Argon
- Helium
- Carbon dioxide
- Oxygen

No, the answer is incorrect.

Score: 0

Accepted Answers:

Carbon dioxide

2) Which of the following flux is suitable for welding titanium and aluminum alloys? **1 point**

- $\text{CaF}_2\text{-BaCl}_2\text{-NaF}$
- $\text{CaF}_2\text{-CaO-Al}_2\text{O}_3$
- $\text{CaF}_2\text{-CaO-SiO}_2$
- MnO-SiO_2

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\text{CaF}_2\text{-BaCl}_2\text{-NaF}$

3) Which of the following parameter determines size of the solidification structure? **1 point**

- Temperature gradient (G)
- Growth rate (R)
- Product of G and R
- Ratio of G and R

No, the answer is incorrect.

Score: 0

Accepted Answers:

Product of G and R

4) The mode of solidification is determines by which of the following parameter? **1 point**

- Quiz : Assignment 6
- Lecture Content (WEEK 6)
- Assignment 6 (Solution)

Week 7: Welding and Joining of Non-Metals

Week 8: Metal Transfer in Welding and Metal Printing

- Ratio of G and R
- Temperature gradient (G)
- Growth rate (R)
- Product of G and R

No, the answer is incorrect.

Score: 0

Accepted Answers:

Ratio of G and R

5) What is the condition for a planar solid liquid interface to be stable at the steady state? **1 point**

- $\frac{G}{R} < \frac{\Delta T}{D_L}$
- $\frac{G}{R} \geq \frac{\Delta T}{D_L}$
- $\frac{G}{R} \neq \frac{\Delta T}{D_L}$
- $\frac{G}{R} < \frac{D_L}{\Delta T}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\frac{G}{R} \geq \frac{\Delta T}{D_L}$$

6) The possible easy-growth direction of columnar dendrites in ferritic stainless steels is? **1 point**

- $\langle 10\bar{1}0 \rangle$
- $\langle 110 \rangle$
- $\langle 101 \rangle$
- $\langle 100 \rangle$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\langle 100 \rangle$

7) Which of the following nucleation process has to overcome a less critical energy barrier to form stable nuclei in the weld metal? **2 points**

- Heterogeneous nucleation
- Homogeneous nucleation
- Both heterogeneous and homogeneous nucleation has to overcome same critical energy barrier
- Nucleation is independent of critical energy barrier

No, the answer is incorrect.

Score: 0

Accepted Answers:

Heterogeneous nucleation

8) Which one of the following techniques is **NOT** suitable for obtaining fine grains in the weld fusion zone? **2 points**

- Arc pulsation
- Weld pool stirring

- By rapid cooling of the fusion zone
- By slow cooling of the fusion zone

No, the answer is incorrect.

Score: 0

Accepted Answers:

By slow cooling of the fusion zone

9) With decreasing in G/R ratio (where G- temperature gradient and R- growth rate) the mode of solidification changes in the sequence **2 points**

- Cellular → Planar → Equiaxed → Columnar dendritic
- Cellular → Equiaxed → Columnar dendritic → Planar
- Planar → Cellular → Columnar dendritic → Equiaxed
- Equiaxed → Cellular → Planar → Columnar dendritic

No, the answer is incorrect.

Score: 0

Accepted Answers:

Planar → Cellular → Columnar dendritic → Equiaxed

10) Which grain structure is more susceptible to solidification cracking? **2 points**

- Coarse columnar grain
- Fine equiaxed grain
- Both of the above are equally susceptible to solidification cracking
- Grain structure has no effect on solidification cracking

No, the answer is incorrect.

Score: 0

Accepted Answers:

Coarse columnar grain

11) Postweld heat treatment of the welded component results in tempering of martensite which further results in **2 points**

- increasing ductility and toughness
- increasing hardness
- rise in residual stresses
- increasing in distortion

No, the answer is incorrect.

Score: 0

Accepted Answers:

increasing ductility and toughness

12) For the solidification of a pure metal, calculate the critical radius (r^*) and the activation free energy if the nucleation is homogeneous. Values for the latent heat of fusion and surface free energy are $-1.2 \times 10^9 \text{ J/m}^3$ and 0.14 J/m^2 respectively. The value of melting temperature and degree of supercooling are 1300°C and 295°C respectively. **2 points**

- 1.3 nm and $9 \times 10^{-16} \text{ J}$ respectively
- 1.24 nm and $9 \times 10^{-16} \text{ J}$ respectively
- 1.24 nm and $9 \times 10^{-19} \text{ J}$ respectively
- 1.3 nm and $9 \times 10^{-19} \text{ J}$ respectively

No, the answer is incorrect.

Score: 0

Accepted Answers:

1.24 nm and $9 \times 10^{-19} \text{ J}$ respectively

13) For a binary alloy system the equilibrium freezing range is about 50°C . If the growth rate is $5 \times 10^{-3} \text{ mm/s}$ and the diffusion coefficient D_L is $2.5 \times 10^{-3} \text{ mm}^2/\text{s}$, the **2 points**

minimum temperature gradient required for planar solidification at the weld centerline is

- 100 °C/mm
- 105 °C/mm
- 110 °C/mm
- 25 °C/mm

No, the answer is incorrect.

Score: 0

Accepted Answers:

100 °C/mm

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