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NPTEL

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Courses » Advances in Welding and Joining Technologies

Announcements Course Ask a Question Progress Mentor

# Unit 6 - Week 5: Micro and Nano Joining Processes

## Course outline

How to access the portal

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

Week 5: Micro and Nano Joining Processes

- Lesson 1: Micro and Nano Joining Processes Part I
- Lesson 2: Micro and Nano Joining Processes Part II
- Lesson 3: Micro and Nano Joining Processes Part III
- Quiz : Assignment 5
- Lecture Content (WEEK 5)

## Assignment 5

The due date for submitting this assignment has passed. **Due on 2018-03-11, 23:59 IST.**

### Submitted assignment

1) The variant of plasma arc welding (PAW) with current less than 15 A is known **2 points** as

- Melt-in mode
- Keyhole mode
- Non-transferred arc mode
- Micro-plasma mode

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*Micro-plasma mode*

2) In bio-medical components, the guide wire for catheter application used to join **2 points** with Nitinol is mainly

- SS 301L
- SS 316H
- SS 316L
- SS 310

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*SS 316L*

3) In a resistance micro-welding process, the applied voltage is 2.5 V and overall **0 points** contact resistance between butt joined sheets is  $2 \times 10^{-4}$  ohm-cm<sup>2</sup>. The amount of heat generated per unit area (in W/cm<sup>2</sup>) is

- $10^3$
- $10^4$
- $2 \times 10^3$
- $2.25 \times 10^4$

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*$2.25 \times 10^4$*

Assignment 5  
(Solution)

Week 6: Welding  
Metallurgy

Week 7: Welding  
and Joining of  
Non-Metals

Week 8: Metal  
Transfer in  
Welding and  
Metal Printing

4) In a laser welding process, the average laser power is 200 W and it is focused **2 points** on a circular area of diameter 200  $\mu\text{m}$ . The power density (in  $\text{W}/\text{m}^2$ ) of focused laser is

- $(2/\pi) \times 10^{10}$
- $(1/\pi) \times 10^8$
- $(2/\pi) \times 10^8$
- $(1/\pi) \times 10^{10}$

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

$(2/\pi) \times 10^{10}$

5) Based on the shear strength of the joint, the ascending order of bondability in **2 points** the process of bonding with nano-particles is

- Ni > Al > Ag
- Ni > Ag > Al
- Al > Ag > Ni
- Ag > Cu > Ti

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

$Ag > Cu > Ti$

6) In microelectronics wire bonding, which one of the following joining principles **2 points** is generally followed ?

- Adhesive bonding
- Laser transmission welding
- Ultrasonic welding
- Brazing

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*Ultrasonic welding*

7) In a solid state nano-bonding process, with reduction in size of nano-particles **2 points**

- the diffusion process will be retarded.
- the sintering and bonding temperature will decrease.
- the specific surface energy will decrease.
- the activation energy of the process will increase.

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*the sintering and bonding temperature will decrease.*

8) Consider the five phases of laser droplet welding: B - droplet creation, A - **2 points** droplet detachment, D - droplet flight, C - droplet landing, E - droplet solidification.

- A - B - E - C - D
- A - B - C - D - E
- A - B - E - D - C
- B - A - D - C - E

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

$B - A - D - C - E$

9) Which of the following statement is correct related to electron beam micro-welding process ? **2 points**

- Scanning electron microscope (SEM) cannot be converted to electron beam (EB) microwelding by modifying optics
- Apertures reduce the excess electron in SEM
- Condenser lens reduces the effective beam power in SEM
- Microwelding mode by EB is produced by removal of the apertures and one condenser lens

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*Microwelding mode by EB is produced by removal of the apertures and one condenser lens*

10) In a diffusion bonding process between carbon into iron, the process is carried out at 1000°C. The activation energy for diffusion is 157 kJ/mol, diffusion constant  $D_0$  for carbon in iron  $0.7 \times 10^{-4} \text{ m}^2/\text{s}$ , and universal gas constant is 8.314 J/mol-K. The value of diffusion coefficient (in  $\text{m}^2/\text{s}$ ) at 1000°C is **2 points**

- $2.53 \times 10^{-11}$
- $4.42 \times 10^{-13}$
- $4.42 \times 10^{-12}$
- $2.53 \times 10^{-12}$

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*$2.53 \times 10^{-11}$*

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