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# Unit 14 - Week 11 - Mechanical Behaviour of Materials II

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Course outline

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Supplementary Materials

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## Assignment 11

**The due date for submitting this assignment has passed.**
**As per our records you have not submitted this assignment.** **Due on 2019-04-17, 23:59 IST.**

1) A polycrystalline material, with an average grain diameter of 24 μm has a yield strength of 600 MPa. After annealing, the material is found to have a yield strength of 450 MPa. What is the average grain diameter (in μm) of the annealed sample? Given: $\sigma_\infty$ = 100 MPa ***1 point***

- 40
- 31
- 49
- 36

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*49*

2) At the peak aged condition, the alloy will have _____. ***1 point***

- large number of fine precipitates
- large number of coarse precipitates
- small number of fine precipitates
- small number of coarse precipitates

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*large number of fine precipitates*

3) Choose the correct statement regarding the mechanism of plastic deformation: ***1 point***
P: All the interatomic bonds break and form again at once
Q: The interatomic bonds break and form again locally. All the bonds do not break and form together.

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- P is assumed to obtain the theoretical CRSS. This is also observed experimentally.

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*P is assumed to obtain the theoretical CRSS. This is not observed experimentally because in reality Q is true.*

4) P: Dislocations are the reason why the real crystals have strengths lower than the theoretical CRSS. ***1 point***
Q: On increasing the dislocation density, the crystal keeps getting weaker.
Choose the statement:

- Both P and Q are true
- Both P and Q are false
- P is true and Q is false
- P is false and Q is true

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*P is true and Q is false*

5) What happens to a polycrystalline material upon plastic deformation? ***1 point***

- All the dislocations come out of the material and the strength reaches the theoretical CRSS
- The dislocation density reduces but the dislocations do not disappear completely. This results in strengthening of the material
- The dislocations get entangled and they multiply to increase the dislocation density. This hinders the motion of dislocations and increases the strength of the material
- The dislocation density increases leading to weakening of the material

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*The dislocations get entangled and they multiply to increase the dislocation density. This hinders the mo of dislocations and increases the strength of the material*

6) During grain growth, ***1 point***
i) the total grain boundary area _____,
ii) the total number of grains _____.

- i) increases ii) decreases
- i) decreases ii) decreases
- i) decreases ii) increases
- i) increases ii) increases

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*i) decreases ii) decreases*

7) A dislocation with Burgers vector b (|b|= 2.56 Å) moving on its slip plane gets pinned by two precipitates separated by a distance of 20 μm. If the shear modulus of the crystal is 45 GPa, find the stress required ($\tau_1$) to bow the pinned dislocation into a semi-circular shape. Also find the stress required ($\tau_2$) if the separation between the precipitates is halved. ***1 point***

$\tau_1 = 5.76$ MPa and $\tau_2 = 11.52$ MPa

$\tau_1 = 11.52$ MPa and $\tau_2 = 5.76$ MPa

$\tau_1 = 576$ kPa and $\tau_2 = 1.152$ MPa

$\tau_1 = 1.152$ GPa and $\tau_2 = 576$ kPa

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\tau_1 = 576$ *kPa and* $\tau_2 = 1.152$ *MPa*

8) In a CCP crystal with a lattice parameter $a$, comment on the possibility of two dislocations with Burgers vectors $\mathbf{b}_1 = \frac{a}{2}[110]$ and $\mathbf{b}_2 = \frac{a}{2}[01\bar{1}]$ combining to form a new dislocation? ***1 point***

They will combine to form a sessile dislocation with $\mathbf{b} = \frac{a}{2}[12\bar{1}]$

They will combine to form a glissile dislocation with $\mathbf{b} = \frac{a}{2}[12\bar{1}]$

They will not combine

They will combine to form a glissile dislocation with $\mathbf{b} = \frac{a}{2}[101]$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*They will not combine*

9) Which of the following strengthening mechanisms cannot be achieved through alloying? ***1 point***
P: solid solution strengthening
Q: strain hardening
R: precipitation hardening

P

Q

P and R

P and Q

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Q*

10) "Only equilibrium precipitates lead to precipitation hardening." True/False? ***1 point***

True

False

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*False*

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