

## NPTEL

## Unit 5 - Week 4

## **Assignment 4**

1) A plate of iron is exposed to a carburizing (carbon-rich) atmosphere on one side and a  1 podecarburizing (carbon-deficient) atmosphere on the other side at 700oC (). If a condition of steady stars achieved, calculate the diffusion flux of carbon through the plate if the concentrations of carbon at positions of 5 and 10 mm (5x10-3 and 10-2) beneath the carburizing surface are 1.2 and 0.8 kg/m3, respectively. Assume a diffusion coefficient of 3x10-11 m2/s at this temperature.  3.4x10-9 kg/m2/s  2.4x10-9 kg/m2/s  5x10-9 kg/m2/s  1.2x10-9 kg/m2/s	oint ate
Accepted Answers: 2.4x10-9 kg/m2/s	
2) Which one is odd on out?	oint
<ul> <li>The free surface of a crystal</li> <li>Solidus and liquidus line</li> <li>Grain boundaries</li> <li>Interphase interfaces</li> <li>None of them</li> </ul>	
Accepted Answers: Solidus and liquidus line	
3) For the case of liquid which on is correct?	oint
<ul> <li>Surface tension is lower than surface energy</li> <li>Surface tension is higher than surface energy</li> <li>Surface tension is equal to surface energy</li> <li>No relation between surface tension and surface energy</li> </ul>	
Accepted Answers: Surface tension is equal to surface energy	

4) What is the correct order of increasing density of atoms in the planes for FCC metals

1 point

Accepted Answers:    220 < 200 < 111    (211)< 200 < 200 < 111 < (211)< (220)< (220)< (200)< (2111)< (220)< (220)< (200)< (2111)< (220)< (220)< (220)< (220)< (220)< (220)< (220)< (2111)< (200)     Accepted Answers:   (111)<  (200)<  (220)   6) When misorientation angle between two grains exceeds beyond 15 degrees, the dislocation   1 point spacing become	<pre>{220}&lt;{200}&lt;{111} {111}&lt;{200}&lt;{220} {200}&lt;{111}&lt;{220} {220}&lt;{111}&lt;{200}</pre>	
{220}<{200}<{111}   {111}<{200}<{220}   {200}<{111}}   {211}<{220}   {220}<{111}<{200}   {220}<{111}<{200}   {220}<{111}<{200}   {220}<{111}<{200}   {220}<{111}<{200}   {220}<{20}    6) When misorientation angle between two grains exceeds beyond 15 degrees, the dislocation 1 point spacing become   small	-	
{111}<{200}<{220}   {200}<{111}<{220}   {220}<{111}<{200}   {220}<{111}<{200}   {220}<{111}<{200}   {220}<{111}<{200}   {220}<{111}<{200}   {220}<{111}<{200}   {200}<{111}<{200}   {200}<{200}  {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}<{200}   {200}   {	5) The number of broken bonds at the surface will increase through the series	1 point
{200}<  {111}<  {220}     {220}<  {111}<  {200}     {220}<  {111}<  {200}     {220}<  {111}<  {200}     {220}<  {111}<  {200}     {220}<  {211}<  {200}<  {220}     (111)<  {220}  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (200)<  {220}     (	{220}<{200}<{111}	
Accepted Answers: {111}<{200} Accepted Answers: {111}<{200}<{220} 6) When misorientation angle between two grains exceeds beyond 15 degrees, the dislocation 1 point spacing become  small large remains constant not related  Accepted Answers: small single remains constant on related  Accepted Answers: small single remains constant not related  Accepted Answers: small single remains constant single of degrees corresponds to twins in FCC materials.  1 point single remains constant single of and single remains constant single remains single remains constant single remains sing	{111}<{200}<{220}	
Accepted Answers: {\( \) \( \)		
(111)<(200)<(220) 6) When misorientation angle between two grains exceeds beyond 15 degrees, the dislocation 1 point spacing become small large remains constant not related  Accepted Answers: small 90 30 60 45 15  Accepted Answers: 60 8) Energy of coherent twin boundary is approx mJ/m2. 1 point 10 30 100 1 50  Accepted Answers: 1		
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10 30 100 11 50  Accepted Answers:		1 noint
30 100 1 50  Accepted Answers:		r point
100 1 50 Accepted Answers:		
1 50  Accepted Answers:		
Accepted Answers:		
1	O 50	
9) Metal with the high melting temperature have (*Ls- heat of sublimation) 1 point		
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High value of Ls and low value of surface energies	High value of Ls and low value of surface energies	

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<ul> <li>Low value of Ls and high value of surface energies</li> <li>High value of Ls and high value of surface energies</li> <li>Low value of Ls and low value of surface energies</li> </ul>	
Accepted Answers: High value of Ls and high value of surface energies	
10)Energy of twin boundary is very sensitive to	1 point
<ul> <li>solute concentration</li> </ul>	
orientation	
defect concentration	
onone of these	
Accepted Answers: orientation	
11)Coherent and incoherent interface have interfacial energy of approx and mJ/m2 respectively.	1 point
O 400, 500	
O 600, 100	
200, 1000	
O 1000, 200	
Accepted Answers: 200, 1000	
12)Coherency strains are found in interface.	1 point
coherent	
semicoherent	
incoherent	
onone of these	
Accepted Answers: coherent	
13 <sup>A</sup> tilt boundary occurs when the axis of rotation is	1 point
Perpendicular to boundary plane	
Parallel to boundary plane	
Mixed boundary plane	
O None on them	
Accepted Answers:  Parallel to boundary plane  14. Why the surface energy increases at a decreasing rate after 10.15 degree in the variation of	1 point
14)Why the surface energy increases at a decreasing rate after 10-15 degree in the variation of grain boundary energy and misorientation?	ι μοιπί
as misorientation decrease the strain fields of the dislocations progressively add up	
<ul> <li>as misorientation decreases the strain fields of the dislocations progressively cancel out</li> <li>as misorientation increases the strain fields of the dislocations progressively add up</li> </ul>	

## Phase Transformation in Materials - - Unit 5 - Week 4

as misorientation increases the strain fields of the dislocations progressively cancel out	
Accepted Answers: as misorientation increases the strain fields of the dislocations progressively cancel out	
15)Which one contain maximum boundary free energy?	1 point
Coherent interface Incoherent interface Semi-coherent interface Twin Boundary	
Accepted Answers:	