



EMA5001 Lecture 22

Kinetics Trivia



Thermodynamics vs. Kinetics

Oxidation of nickel in air at room temperature is limited by

A. Thermodynamics

B. Kinetics

C. Both

D. Not sure



Grain Boundary

- Compared with single crystal metal, a similar metal with fine grains and a lot of grain boundaries has
- A. Higher total free energy per mole
 - B. Lower total free energy per mole
 - C. Not sure



Nucleation

- The critical nucleus radius of curvature r^* for homogeneous nucleation and heterogeneous nucleation is often
- A. Different
 - B. Same
 - C. Not sure



Diffusion Coefficient

As temperature increases, the diffusion coefficient typically

- A. Decreases
- B. Increases
- C. Not sure



Spinodal Decomposition

For spinodal decomposition, the diffusion is

- A. Downhill
- B. Uphill
- C. Both
- D. Not sure



Grain Growth

The driving force for grain growth comes from

- A. Lowering of bulk energy
- B. Lowering of grain boundary energy
- C. Not sure



Steady State Diffusion

Under steady state diffusion, which is constant

- A. Concentration gradient
- B. Diffusion coefficient
- C. Diffusion flux
- D. None



Steady State vs. Equilibrium

- For a fuel cell operated at constant current condition, it is
- A. At equilibrium
 - B. At steady-state
 - C. Neither case



Fick's 1st Law

□ Which equation is Fick's 1st Law in 1D

A. $J = -D \frac{d^2C}{dx^2}$

B. $J = -D \frac{dC}{dx}$

C. $J = -D \frac{dx}{dC}$



Interstitial vs. Substitutional Diffusion

In C-Fe system, which one diffuses faster at the same condition

A. Iron atoms

B. Carbon

C. Not sure



Solidification

- When we say a liquid metal is supercooled, we mean
 - A. It is cooled extremely fast
 - B. It is cooled to a super state
 - C. Its temperature is cooled to a point above its melting point
 - D. Its temperature is cooled to a point below its melting point



Nucleation & Growth

- In nucleation and growth for precipitates, the barrier to nucleation may come from
- A. Added interfacial energy associated with interface
 - B. Bulk molar free energy difference between the precipitate and matrix
 - C. Undercooling



Spinodal Decomposition

□ For spinodal decomposition, the free energy vs composition curve satisfies

A. $\frac{d^2G}{dX^2} > 0$

B. $\frac{d^2G}{dX^2} = 0$

C. $\frac{d^2G}{dX^2} < 0$

D. Not sure



Massive Transformation

Which statement about massive transformation is wrong

- A. Massive transformation does not involve significant long-range diffusion
- B. Massive transformation typically does not involve composition change
- C. Massive transformation is equivalent as Martensite transformation
- D. Massive transformation happen is pretty fast cooling rate
- E. All of above



Order-Disorder Transformation

Which statement is right about order-disorder transformation

- A. Ordered phase exists at higher temperature while disordered phase exist at lower temperature
- B. In A-B ordered phase, A atoms prefer to be bond with A and B atoms prefer to be bond with A
- C. Order-disorder transformation can be 1st order or 2nd order phase transformation
- D. All of the above



Nucleation Rate

Nucleation rate for precipitation in solid is usually fastest at

- A. Extremely small undercooling due to very fast diffusion
- B. Extremely large undercooling due to large driving force
- C. Intermediate undercooling
- D. Not sure