

Exam #2 Topics

Glasses

Definition of Glassy Materials

Long-range vs. Short-range order

ill-defined melting point (Specific Volume vs. Temperature)

Effect of Viscosity on Glasses

Zachariasen's Rules

Thermal Effects in Glasses

Thermal Shock

Tempering

Polymers as Glasses

Influences on Crystallinity

Phase Diagrams

Cooling Curves and Binary Phase Diagrams

Immiscible Materials

Eutectics

Other Invariants

TTT Diagrams

Nucleation

Heterogeneous vs. Homogeneous

Competition between clustering and thermal instability; critical size

Growth

The Avrami Relation

Diffusional vs. Diffusionless Transformations

The Fe/Fe₃C Phase Diagram

Influence of Cooling Rate on Microstructure

- Pearlite, Bainite, Martensite, etc.

Influence of Microstructure on Properties

Non-Ferrous Metals

Electronic Properties

Ohm's Law; Conductivity & Mobility

Mathiessen's Rule

The Cause of Band Structure

Statistical Filling of Bands; Fermi-Dirac Stats

The Difference Between Conductors, Insulators, and Semiconductors

Explained by band structure

Treatment of an Electron as a Wave

Uncertainty Principle

Schrödinger Equation

Free electrons

Confined to a Potential Well

Tunneling Through a Barrier

The Kronig-Penny Model

Semiconductor Statistics

Fermi-Dirac Function

The Fermi Level

Density of States

Effect of Doping on Concentration of Holes and Electrons
Influence of Band Gap and Thermal Props on Carrier Concentration

Semiconductor Devices

The pn Junction Diode
Contact Potentials
Solar Cells
Ohmic vs. Schottky Contacts
The HBT
The MOSFET
Quantum Well Devices
Microfabrication & Moore's Law
Future Possibilities

Magnetic Properties

Difference Between Field and Induction

Diamagnetic, Paramagnetic, and Ferromagnetic Materials

Hysteresis