



Introduction to Glass Properties: Course Outline

Course Description

Learn the significant properties of glass, both theoretically and experimentally

This course is an intensive combination of virtual lectures and laboratory demonstrations that address most of the significant properties of glass, both theoretically and experimentally. The individual sessions are titled in the accompanying outline.

The lectures are organized to define each property, examine thermal and compositional effects, and describe practical measurement techniques. The laboratory demonstrations are designed to give the participants experience with common glass property tests.

Topics / Activities During Class
<ul style="list-style-type: none"> • Introduction to Glass <ul style="list-style-type: none"> • Definition of Glass • Glass Transformation Region/ASTM E1356 Glass Transition Temperatures by DSC • Kinetic Theory of Glass Formation <ul style="list-style-type: none"> • Nucleation Rate • Crystal Growth Rate • T–T–T Diagram/ASTM E794 Melting and Crystallization Temperatures by DTA/ASTM C829 Liquidus Temperature • Structure of Glass <ul style="list-style-type: none"> • Random Network Theory • Bond Strength Criterion • Elements of Structural Models • Chemical Compositions • Phase Separation <ul style="list-style-type: none"> • Thermodynamics • Mechanisms • Phase Diagrams • Density <ul style="list-style-type: none"> • Definition • Composition Effects • Thermal History Effects • Measurement Techniques/ASTM C604 True Specific Gravity • Viscosity <ul style="list-style-type: none"> • Definition • Viscoelasticity • Temperature Dependence • Composition / Temperature Effects • Thermal History Effects • Measurement Techniques/ASTM C336 Annealing and Strain Point/ASTM C598 Annealing and Strain Point/ASTM C338 Softening Point/ASTM C1350 Viscosity by Beam Bending/ASTM C965 Viscosity of Molten Glass • Thermal Expansion



- Definition
- Composition Effects
- Thermal History Effects
- Thermal Stresses
- Measurement Techniques/ASTM E228 Thermal Linear Expansion/Contraction
- Heat Capacity
 - Definition
 - Temperature Dependence
 - Composition Effects
 - Measurement Techniques/ASTM E1269 Heat Capacity by DSC
- Thermal Conductivity
 - Definition
 - Phonon Conductivity
 - Photon Conductivity
 - Temperature Dependence
 - Composition Effects
 - Measurement Techniques/ASTM E1461 Thermal Conductivity by Laser Flash
- Elasticity
 - Definition
 - Atomistic Approach
 - Temperature Dependence
 - Composition Effects
 - Measurement Techniques/ASTM E494 Ultrasonic Velocity in Materials/ASTM C1259 Young's Modulus
- Strength
 - Definition
 - Theoretical Strength
 - Practical Strength
 - Fracture Mechanics
 - Fatigue
 - Slow Crack Growth
 - Fractographic Analysis
 - Fracture Statistics
 - Strengthening of Glass
 - Thermal Shock
 - Measurement Techniques/ASTM C158 Flexural Strength/ASTM C1499 Equibiaxial Flexural Strength/ASTM 1525 Thermal Shock Resistance
- Electric Conductivity
 - Definition
 - Ionic Conductivity
 - Temperature Dependence
 - Composition Effects
 - Thermal History Effects
 - Measurement Techniques/ASTM C657 Electrical Resistivity