

Table of Contents

- Chapter 1. The Melt
 - 1.1. Reactions of the Melt with its Environment
 - 1.2. Transport of Gases in Melts
 - 1.3. Surface Film Formation
 - 1.4. Vaporisation

Chapter 2. Entrainment

- 2.1. Entrainment Defects
- 2.2. Entrainment Processes
- 2.3. Furling and Unfurling
- 2.4. Deactivation of Entrained Films
- 2.5. Soluble, Transient Films
- 2.6. Detrainment
- 2.7. Evidence for Bifilms
- 2.8. The Importance of Bifilms
- 2.9. The Four Common Populations of Bifilms

Chapter 3. Flow

- 3.1. Effect of Surface Films on Filling
- 3.2. Maximum Fluidity (The Science of Unrestricted Flow)
- 3.3. Extended Fluidity
- 3.4. Continuous Fluidity

Chapter 4. Moulds and Cores

- 4.1. Moulds: Inert or Reactive
- 4.2. Transformation Zones
- 4.3. Evaporation and Condensation Zones
- 4.4. Mould Atmosphere
- 4.5. Mould Surface Reactions
- 4.6. Metal Surface Reactions
- 4.7. Mould Coatings

Chapter 5. Solidification Structure

- 5.1. Heat Transfer
- 5.2. Development of Matrix Structure
- 5.3. Segregation

Chapter 6. Casting Alloys

- 6.1. Zinc Alloys

- 6.2. Magnesium Alloys
- 6.3. Aluminium
- 6.4. Copper Alloys
- 6.5. Cast Iron
- 6.6. Steels
- 6.7. Nickel-Base Alloys
- 6.8. Titanium

Chapter 7. Porosity

- 7.1. Shrinkage Porosity
- 7.2. Gas Porosity
- 7.3. Porosity Diagnosis

Chapter 8. Cracks and Tears

- 8.1. Hot Tearing
- 8.2. Cold Cracking

Chapter 9. Properties of Castings

- 9.1. Test Bars
- 9.2. The Statistics of Failure
- 9.3. Effect of Defects
- 9.4. Tensile Properties
- 9.5. Fracture Toughness
- 9.6. Fatigue
- 9.7. Elastic (Young's) Modulus and Damping Capacity
- 9.8. Residual Stress
- 9.9. High Temperature Tensile Properties
- 9.10. Oxidation and Corrosion Resistance
- 9.11. Leak-Tightness
- 9.12. Surface Finish
- 9.13. Quality Indices
- 9.14. Bifilm-Free Properties

Section 1 Casting Manufacture: Introduction to the Casting Manufacturing Industry

Chapter 10. The 10 Rules for Good Castings

- 10.1. Rule 1: Use a Good-Quality Melt
- 10.2. Rule 2: Avoid Turbulent Entrainment (The Critical Velocity Requirement)
- 10.3. Rule 3: Avoid Laminar Entrainment of the Surface Film (The Non-Stopping, Non-Reversing Condition)
- 10.4. Rule 4: Avoid Bubble Damage

- 10.5. Rule 5: Avoid Core Blows
- 10.6. Rule 6: Avoid Shrinkage Damage
- 10.7. Rule 7: Avoid Convection Damage
- 10.8. Rule 8: Reduce Segregation Damage
- 10.9. Rule 9: Reduce Residual Stress
- 10.10. Rule 10: Provide Location Points

Section 2. Filling System Design

Chapter 11. Filling System Design Fundamentals

- 11.1. The Maximum Velocity Requirement
- 11.2. Gravity Pouring: The 'No-Fall' Conflict
- 11.3. Reduction or Elimination of Gravity Problems
- 11.4. Surface Tension Controlled Filling

Chapter 12. Filling System Components

- 12.1. Pouring Basin
- 12.2. Sprue (Down-Runner)
- 12.3. Runner
- 12.4. Gates
- 12.5. Surge Control Systems
- 12.6. Vortex Systems
- 12.7. Inclusion Control: Filters and Traps
- 12.8. Filters

Chapter 13. Filling System Design Practice

- 13.1. Background to the Methoding Approach
- 13.2. Selection of a Layout
- 13.3. Weight and Volume Estimates
- 13.4. Pressurised versus Unpressurised
- 13.5. Selection of a Pouring Time
- 13.6. Thin Sections and Slow Filling
- 13.7. Fill Rate
- 13.8. Pouring Basin Design
- 13.9. Sprue (Down-Runner) Design
- 13.10. Runner Design
- 13.11. Gate Design

Section 3. Processing (Melting, Moulding, Casting, Solidifying)

Chapter 14. Melting

- 14.1. Batch Melting

- 14.2. Continuous Melting
- 14.3. Holding, Transfer and Distribution
- 14.4. Melt Treatments
- 14.5. Cast Material
- 14.6. Re-melting Processes

Chapter 15. Moulding

- 15.1. Inert Moulds and Cores
- 15.2. Aggregate Moulding Materials
- 15.3. Binders
- 15.4. Other Aggregate Mould Processes
- 15.5. Rubber Moulds
- 15.6. Reclamation and Re-cycling of Aggregates

Chapter 16. Casting

- 16.1. Gravity Casting
- 16.2. Horizontal Transfer Casting
- 16.3. Counter-gravity
- 16.4. Centrifugal Casting
- 16.5. Pressure-Assisted Casting
- 16.6. Lost Wax and Other Ceramic Mould Casting Processes
- 16.7. Lost Foam Casting
- 16.8. Vacuum Moulding (V Process)
- 16.9. Vacuum-Assisted Casting
- 16.10. Vacuum Melting and Casting

Chapter 17. Controlled Solidification Techniques

- 17.1. Conventional Shaped Castings
- 17.2. Directional Solidification
- 17.3. Single Crystal Solidification
- 17.4. Rapid Solidification Casting

Chapter 18. Dimensional Accuracy

- 18.1. The Concept of Net Shape
- 18.2. Mould Design
- 18.3. Mould Accuracy
- 18.4. Tooling Accuracy
- 18.5. Casting Accuracy
- 18.6. Metrology

Chapter 19. Post-casting Processing

- 19.1. Surface Cleaning
- 19.2. Heat Treatment
- 19.3. Hot Isostatic Pressing
- 19.4. Machining
- 19.5. Painting
- 19.6. Plastic Working (Forging, Rolling, Extrusion)
- 19.7. Impregnation
- 19.8. Non-Destructive Testing