

Leseprobe

1. Introduction to Rheology
 - 1.1 The Field of Rheology
 - 1.2 Viscous Liquids or the Newtonian Fluid
 - 1.3 Linear Elasticity or the Hookean Spring
 - 1.4 Viscoelasticity and the Maxwell Model
 - 1.5 Time Scale and the Deborah Number
 - 1.6 Deformation, Rate of Deformation and Deviatoric Stress Tensors
 - 1.7 Book Guide
2. Structure and Properties of Deforming Polymers
 - 2.1 Molecular Structure of Polymers
 - 2.2 Stress Relaxation Behavior
 - 2.3 Shear Thinning Behavior
 - 2.4 Normal Stresses in Shear Flow
 - 2.5 Stress Overshoot during Start-up Flow
 - 2.6 Melt Strength or Melt Fracture
 - 2.7 Dynamic Response
3. Generalized Newtonian Fluid Models (GNF)
 - 3.1 Viscosity Temperature Dependence
 - 3.2 Viscous Flow Models
 - 3.2.1 The Power Law Model
 - 3.2.2 The Bird–Carreau–Yasuda Model
 - 3.2.3 The Cross-WLF Model
 - 3.2.4 The Bingham Model
 - 3.2.5 The Herschel Bulkley Model
 - 3.2.6 Accounting for Pressure Dependence in Viscous Flow Models
 - 3.3 Elongational Viscosity
 - 3.4 Suspension Rheology
 - 3.5 Chemo-Rheology
4. Transport Phenomena
 - 4.1 Dimensionless Groups
 - 4.2 Balance Equations
 - 4.2.1 The Mass Balance or Continuity Equation
 - 4.2.2 The Material or Substantial Derivative
 - 4.2.3 The Momentum Balance or Equation of Motion
 - 4.2.4 The Energy Balance or Equation of Energy
 - 4.3 Model Simplification
 - 4.3.1 Reduction in Dimensionality
 - 4.3.2 Lubrication Approximation
 - 4.4 Viscometric Flows
 - 4.4.1 Pressure Driven Flow of a Newtonian Fluid through a Slit

- 4.4.2 Flow of a Power Law Fluid in a Straight Circular Tube (Hagen-Poiseuille Equation)
- 4.4.3 Volumetric Flow Rate of a Power Law Fluid in Axial Annular Flow
- 4.4.4 Circular Annular Couette Flow of a Power-Law Fluid
- 4.4.5 Squeezing flow of a Newtonian Fluid between Two Parallel Circular Discs
- 4.4.6 Flow of a Power-Law Fluid Between Two Parallel Circular Discs
- 5. Viscoelasticity
 - 5.1 Linear Viscoelasticity
 - 5.1.1 Relaxation Modulus
 - 5.1.2 The Boltzmann Superposition Principle
 - 5.1.3 The Maxwell Model - Relaxation
 - 5.1.4 Kelvin Model
 - 5.1.5 Jeffreys Model
 - 5.1.6 Standard Linear Solid Model
 - 5.1.7 The Generalized Maxwell Model
 - 5.1.8 Dynamic Tests
 - 5.2 Non-Linear Viscoelasticity
 - 5.2.1 Objectivity
 - 5.2.2 Differential Viscoelastic Models
 - 5.2.3 Integral Viscoelastic Models
- 6. Rheometry
 - 6.1 The Sliding Plate Rheometer
 - 6.2 The Cone-Plate-Rheometer
 - 6.3 The Parallel-Plate Rheometer
 - 6.4 The Capillary Rheometer
 - 6.4.1 Computing Viscosity
 - 6.4.2 Viscosity Approximation
 - 6.5 The Melt Flow INDEXER
 - 6.6 Extensional Rheometry
 - 6.7 High Pressure Rheometers
 - 6.8 Integrated Mold Sensors