

1. Record Nr.	UNINA9910595028903321
Autore	Schweizer Peter M.
Titolo	Premetered coating methods : attractiveness and limitations // Peter M. Schweizer
Pubbl/distr/stampa	Cham, Switzerland : , : Springer, , [2022] ©2022
ISBN	3-031-04180-1
Descrizione fisica	1 online resource (691 pages)
Collana	Engineering Materials Ser.
Disciplina	668.495
Soggetti	Coatings
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Includes index.
Nota di contenuto	Intro -- Preface -- Motivation for and Purpose of this Book -- Outline of the Book -- Past, Present, and Future of Premetered Coating Methods -- Acknowledgements -- Contents -- About the Author -- Definition of Symbols -- Letters -- Dimensionless Numbers -- Greek Letters -- Part I R& D in Premetered Coating Technology -- 1 Introduction -- 1.1 History of R& D in Coating Technology -- 1.2 History of Dissemination of Knowledge in Coating Technology -- References -- 2 Premetered Versus Selfmetered Coating Methods -- 2.1 Premetered Coating Methods -- 2.2 Selfmetered Coating Methods -- 2.3 Process Limitations -- 2.4 Attractiveness of Premetered Coating Methods -- References -- 3 Mass Balance and Flow Rates -- 3.1 Wet Versus Dry Film Thickness -- 3.2 Flow Rates -- 3.3 Correlations Between Volume-Based and Mass-Based Parameters -- 3.3.1 Units -- 3.3.2 Correlations Based on Dry Coat Weight Adry -- 3.3.3 Correlations Based on Dry Film Thickness Hdry -- 3.3.4 Correlations Based on Porous Film Thickness Hporous -- 3.3.5 Operating Requirements for the Flow Rate -- 3.3.6 Maximum Web Speed Resulting from Drying Limitation -- References -- 4 Physical Fluid Properties -- 4.1 Introduction -- 4.2 Solids Concentration -- 4.2.1 Solids Concentration by Volume -- 4.2.2 Solids Concentration by Weight -- 4.2.3 Measuring the Solids Concentration by Weight -- 4.3 Densities -- 4.3.1 Liquid Density Based on Concentration by Volume -- 4.3.2 Liquid Density Based on Concentration by Mass -- 4.3.3 Solid Density -- 4.4

Rheological Properties -- 4.4.1 Shear Viscosity -- 4.4.2 Shear Rate Ranges of Coating Flows -- 4.4.3 Measurement Devices -- 4.4.4 Rheological Models -- 4.4.5 Concentration Dependence of Viscosity -- 4.4.6 Temperature Dependence of Viscosity -- 4.4.7 Viscoelastic Properties -- 4.5 Surface Tension -- 4.5.1 Surface Tension of Coating Fluids. 4.5.2 Static or Dynamic Surface Tension -- 4.5.3 Methods for Measuring Surface Tension -- 4.5.4 Requirements for Surfactants -- 4.5.5 Selection of Surfactants -- 4.6 Contact Angle and Wetting -- 4.6.1 Static Contact Angle and Spreading Coefficient -- 4.6.2 Measurement of the Contact Angle -- 4.6.3 Wettability of Substrates -- 4.6.4 Wetting Envelope -- References -- 5 Basic Flows of Premetered Coating Methods -- 5.1 Introduction -- 5.2 Vortices in Coating Flows -- 5.3 Strategies for Solving Fluid Flow Problems -- 5.4 Pipe Flow -- 5.4.1 Constant Viscosity (Newtonian Flow Behavior) -- 5.4.2 Shear Rate Dependent Viscosity (Shear Thinning Flow Behavior) -- 5.4.3 Comparison of Flow Models for Solving Pipe Flow Problems -- 5.4.4 Vortices in Pipe Flow -- 5.5 Duct Flow -- 5.5.1 Flow Along the Axis of Ducts -- 5.5.2 Flow Across Ducts -- 5.6 Slot Flow -- 5.6.1 Constant Viscosity (Newtonian Flow Behavior) -- 5.6.2 Shear Rate Dependent Viscosity (Shear Thinning Flow Behavior) -- 5.6.3 Two-Layer Slot Flow (Newtonian Flow Behavior with Carreau-Yasuda Viscosity) -- 5.6.4 Vortices in Slot Flow -- 5.7 Film Flow -- 5.7.1 Single-Layer Film Flow for Constant Viscosity (Newtonian Flow Behavior) -- 5.7.2 Single-Layer Film Flow for Shear-Dependent Viscosity (Power Law Flow Behavior) -- 5.7.3 Multilayer Film Flow for Constant Viscosity (Newtonian Flow Behavior) -- 5.7.4 Waves in Film Flow -- 5.7.5 Standing Waves in Film Flow -- 5.7.6 Surface Age of Film Flow -- 5.7.7 Minimum Flow Rate for Film Flow -- 5.7.8 Vortices in Film Flow -- 5.8 Curtain Flow -- 5.8.1 Curtain Velocity -- 5.8.2 Extension Rate in Curtain Flow -- 5.8.3 Curtain Fall Time -- 5.8.4 Curtain Thickness -- 5.8.5 Curtain Stability -- 5.8.6 Curtain Deflection -- 5.8.7 Vortices in Curtain Flow -- 5.8.8 Neck-in in Curtain Flow -- 5.9 Boundary Layer Flow -- 5.9.1 Concept for Reducing the Boundary Layer Thickness. 5.9.2 Boundary Layer in Slot Flow -- 5.9.3 Boundary Layer in Film Flow -- 5.9.4 Boundary Layer in Curtain Flow -- 5.9.5 Curtain Edge Guides -- 5.9.6 Boundary Layer in Impinging Flow -- 5.9.7 Vortices in Impinging Flow -- 5.10 Flow After Coating -- 5.10.1 Conformity of the Coated Film -- 5.10.2 Web Path Between Coating and Solidifying -- 5.10.3 Leveling -- 5.10.4 Flow Due to Ambient Disturbances -- 5.10.5 Edge Withdrawal -- References -- 6 Wall Shear Stress -- 6.1 Introduction -- 6.2 Cleaning and Contamination -- 6.3 Wall Shear Stress and Die Design -- 6.3.1 Wall Shear Stress in the Inner Cavity -- 6.3.2 Wall Shear Stress in the Outer Cavity -- 6.4 Effect of Variable Coating Width on Wall Shear Stress Distribution -- 6.5 Wall Shear Stress and Fluids with a Yield Stress -- 6.6 Wall Shear Stress and Residence Time -- 6.6.1 Mean Residence Time -- 6.6.2 Mean Residence Time Distribution of a Slot Die -- 6.6.3 Residence Time Spectrum -- 6.6.4 Transfer Function -- 6.6.5 Change-Over Time -- 6.7 Wall Shear Stress and Reactive Fluids -- References -- 7 Dynamic Wetting and Hydrodynamic Assist -- 7.1 Introduction -- 7.2 The Concept of Hydrodynamic Assist -- 7.3 Process Optimization -- References -- Part II General Properties of Premetered Coating Methods -- 8 Preparing, Conditioning, and Delivering Coating Fluids -- 8.1 Introduction -- 8.2 Elements of the Fluid Conditioning and Delivery System -- 8.2.1 Preparation Vessel -- 8.2.2 Coating Vessel -- 8.2.3 Degassing -- 8.2.4 Pump -- 8.2.5 Flow Meter -- 8.2.6 Filter -- 8.2.7 Temperature Control -- 8.2.8 In-Line Mixing -- 8.2.9 In-Line Fluid

Change -- 8.2.10 Pulsation Dampener -- 8.2.11 Pipe Line -- 8.2.12 T-Junction -- 8.2.13 Valves and Fittings -- 8.2.14 5-Way Valve and Recirculation Loop -- 8.2.15 Die -- 8.2.16 Cleaning-In-Place (CIP) -- References -- 9 Film Thickness and Film Thickness Uniformity. 9.1 Introduction -- 9.2 Nominal Film Thickness -- 9.3 Film Thickness Uniformity in Machine Direction -- 9.4 Die Design (Film Thickness Uniformity in Cross-Web Direction) -- 9.4.1 Concepts for Liquid Distribution -- 9.4.2 Film Thickness Nonuniformity -- 9.4.3 Recent Literature on Die Design -- 9.4.4 Die Geometry -- 9.4.5 Modeling Die Performance -- 9.4.6 Bar Deflection -- 9.4.7 Die Design Procedure -- 9.4.8 Analyzing Die Performance -- 9.4.9 Optimization of Die Design -- References -- 10 Concepts for Varying the Coating Width -- 10.1 Introduction -- 10.2 Width Change for Slide Dies -- 10.3 Width Change for Slot Dies -- Reference -- 11 Splice Passage and Coatability -- 11.1 Introduction -- 11.2 Types of Splices -- 11.3 Splice Passage -- 11.4 Splice Coatability -- 12 Simultaneous Multilayer Coating Capability -- 12.1 Introduction -- 12.2 Examples of Multilayer Products -- References -- 13 Mixing of Adjacent Layers -- 13.1 Mixing Due to Convection -- 13.2 Mixing Due to Diffusion -- References -- 14 Guidelines for Designing Single-Layer and Multilayer Films -- 14.1 Introduction -- 14.2 Guidelines for Single-layer Films -- 14.2.1 Viscosity -- 14.2.2 Surface Tension -- 14.3 Guidelines for Multilayer Films -- 14.3.1 Density Structuring -- 14.3.2 Viscosity Structuring -- 14.3.3 Surface Tension Structuring -- 14.3.4 Surface Tension Structuring for Multilayer Curtains -- References -- 15 Modeling Economic Aspects of Coating Methods -- 15.1 Introduction -- 15.2 Effect of the Coating Speed and the Size of the Coating Lot on the Specific Machine Utilization -- 15.3 Effect of the Lot Size and the Non-productive Time on the Specific Machine Utilization -- 15.4 Cost Savings from Reduced Coating Passes -- 15.5 Cost Savings from Improved Coat Weight Uniformity -- Reference -- Part III Specific Properties of Premetered Coating Methods. 16 The Concept of the Coating Window -- 16.1 Introduction -- 16.2 Coating Windows for Premetered Coating Methods -- References -- 17 Specific Properties of Slot Coating -- 17.1 Introduction -- 17.2 Process Configuration and Equipment -- 17.3 Geometry of the Coating Bead -- 17.4 Operating Window -- 17.5 Low Flow Limit -- 17.6 Implications of the Low Flow Limit -- 17.7 The Pressure Profile in the Coating Bead -- 17.8 Coating Defects -- 17.8.1 Ribbing Lines -- 17.8.2 Air Entrainment -- 17.8.3 Vortices -- 17.8.4 Heavy Edges -- 17.8.5 Effect of the Uniformity of the Coating Gap on the Uniformity of the Wet Film Thickness -- 17.9 Process Optimization -- 17.9.1 Optimizing the Viscous Operating Mode -- 17.9.2 Optimizing the Capillary Operating Mode -- 17.10 Operational Aspects -- 17.10.1 Coating Start -- 17.10.2 Coating Stop -- 17.10.3 Cleaning the Die and Changing the Coating Fluid -- 17.10.4 Changing the Coating Width -- 17.10.5 Splice Passage -- 17.10.6 Prevention of Lines and Streaks -- 17.11 Tensioned-Web Coating -- 17.12 Double-Sided Coating -- 17.13 Stripe Coating -- 17.14 Intermittent Coating -- 17.14.1 Trailing Edge -- 17.14.2 Leading Edge -- 17.15 Pattern Coating -- 17.16 Simultaneous Multilayer Coating -- References -- 18 Specific Properties of Slide Coating -- 18.1 Introduction -- 18.2 Process Configuration and Equipment -- 18.3 Flow Field of the Coating Bead -- 18.4 Operating Window -- 18.5 Coating Defects -- 18.5.1 Ribbing Lines -- 18.5.2 Air Entrainment -- 18.5.3 Vortices -- 18.6 Process Optimization -- References -- 19 Specific Properties of Curtain Coating -- 19.1 Introduction -- 19.2 Process Configuration and Equipment -- 19.2.1 Web Path -- 19.2.2 Design of Coating Station -- 19.2.3 Slide

or Slot Die -- 19.2.4 Suction Baffle -- 19.2.5 Operating Modes --
19.2.6 Coating Start and Stop -- 19.3 Operating Window.
19.3.1 Operating Window for Long Curtains.
