Heat Sealing Technology and Engineering for Packaging: Principles and Applications

Kazuo Hishinuma

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This book is the first to cover all phases of heat sealing as it relates to packaging. Beginning with the basics of heat-sealing processes and thermoplastic materials, the book explains, with numerous formulas and original experimental data, all the key parameters. With this information, the author presents new ways to improve the reliability of heat sealing and the quality of heat-sealed packaging. Novel monitoring techniques are provided that enable packaging engineers to better control parameters that lead to safer, more effective seals in pouches, bags and cups, and with different materials, including laminates. Specifically, the author shows how important it is to have accurate measurement of the melting surface. The book explains techniques for carrying out such measurements and demonstrates how they lead to better heat seal process control. These techniques, along with novel ways of using the peel seal and tear seal, are explained in practical terms, to assist engineers to troubleshoot and eliminate problems encountered in heat sealing, e.g., overheating, polyball, and packaging failure. Hundreds of illustrations and numerous case studies support the practical information in this book. The technical data found in this resource is a necessary supplement to JIS and ASTM standards.

1. History and Function of Heat Sealing Technology · Development of Heat Sealing Technology · History of Improvement for Heat Sealing of Thermoplastic Thermoplastics · Maintenance Function of Packaged Product Quality using Heat Sealing · Features of Heat Sealing · Problems of Over Heating for Sealing · Approach of Rationalized Heat Sealing · References 2. The Chemistry of Heat Sealing · Utilization of the Thermoplasticity of Polymer Materials · Adhesion in Heat Sealing · Features of Thermoplastic Polymer Materials for Packaging Applications using Heat Sealing · References 3. The Fundamentals of Heating for Heat Sealing · Aspects of the Responses of the Melting Surface Temperature during Heat Sealing · Strategies for Efficient Heat Sealing · Features and Selected Applications of Heating Methods · Problems with Conventional Evaluation Methods for Heat Sealing · References 4. Fundamentals of Heat Sealing Operation · Melting Surface Temperature as the Fundamental Control Factor in Heat Sealing · Measuring Method for Temperature of Melting Surface: The "MTMS" · Measuring the Melting Properties of Each Film Material and Determining a Lower-Limit Temperature · References 5. Factors in Heat Sealing Failure · Adequate or Inadequate Heating · Thermal Stresses that Cause Packaging Failure · Causes of Crinkles · Controlling Overheating as a Solution for Heat Sealing Failure 6. Making the Conventional Heat Sealing Method More Efficient · Introduction · Measuring the Temperature Response of Each Heat-Seal Portion in Quadruple-Layered Films · Relation between Applied Pressure and the Temperature of the Melting Surface for Heat Sealing · Measurement of the Melting Surface Temperature for Heat Sealing with Films Containing Volatile Components · Effects on Heat Sealing Operations of Teflon Sheet Attached to the Heating Block Surface · Measurement of Surface Temperature Distributions on the Heating Block · Problem Analysis in Single-Side Heating · Other Factors Affecting Temperature Distributions and Radiant Heat on Heat Seal Films · Pros and Cons of Knurling Tool Finish · Changes in Heat Seal Strength Caused by Roughness of the Bonding Surface 100 · References 7. Experimental Technique for Inspecting Peel Seal and Tear Seal · Polyball as a Cause of Package Failure

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