The Complete Technology Book on Plastic Extrusion, Moulding and Mould Designs

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Plastics extrusion is a high volume manufacturing process in which raw plastic material is melted and formed into a continuous profile. Extrusion produces items such as pipe/tubing, weather stripping, fence, deck railing, window frames, adhesive tape and wire insulation. There are fundamentally two different methods of extruding film, namely, below extrusion and slit die extrusion. The design and operation of the extruder up to the die is the same for both methods. The moulding process is one of the most important plastic processing operations. It is an important commercial process whereby a resinous polymeric compound is converted into useful finished articles. The origin of this process is dates back about a century to the invention of a plunger type machine. The mould has its own importance, which give the required shapes of the products. The vast growth of injection moulding is reflected dramatically in many types and sizes of equipment available today. Plastic moulding especially thermoplastic items may be produced by compression moulding methods, but since they are soft at the temperature involved, it is necessary to cool down the mould before they may be ejected. Injection moulding differs from compression moulding is that the plastic material is rendered fluid in a separate chamber or barrel, outside the mould is then forced into the mould cavity by external pressure. Plastic technology is one of the most vigorous manufacturing branches, characterised by new raw materials, changing requirements, and continuous development in processing methods. The injection moulding machines manufacturers plays an important part in the creation of injection moulding technology, process control, to essential mechanical engineering. Even though design is a specialized phase in engineering field, in tool and mould engineering it is totally divided into two wings as product design and tool and die design.
This book basically deals with transport phenomena in polymer films, reinforcements for thermosets, miscellaneous thermoset processes, injection molding, blow molding, extrusion, basic principles of injection moulding, correct injection speed is necessary for filling the mould, plastic melt should not suffer degradation, the mould must be controlled for better quality product, logical consideration of moulding profile and material is important than standard setting guide lines, economical setting of the machine, proper maintenance of machine;, safety operations., preliminary checking for moulding, material, component, mould, machine, injection moulding technique, the various type of injection moulding machines, specifications, platen mounting of moulds, locating spigots, mould clamping, etc.

The book covers manufacturing processes of extruded and moulded products with the various mould designs. This is very useful book for new entrepreneurs, technocrats, researchers, libraries etc.

1. PREPARATION OF PLASMA FILMS

Introduction, Apparatus oor Plasma Polymerization, Electric Power Source, Reaction Chamber, Vacuum System, Control System of Monomer Gas Flow, Mechanism of Plasma Polymerization, Control of Plasma Polymerization, Topics of Plasma Polymerization, Surface Modification, Wettable Surfaces, Water- Repellent Surfaces, Durable Surface Modification, Membranes for Separation, Gas Separation, Liquid Separation, Electrical Materials, Conductive Polymers, Chemical Sensors

2. TRANSPORT PHENOMENA IN POLYMER FILMS

Historical Background, Fun Dam Entals, Measurement of Transport Properties, Permeation Methods, Data Analysis, Sorption Methods, Polymer Properties and Penetrant Behaviour, Effect of Temperature, Nature of the Polymer, Plasticizers and Humidity, Nature of the Penetrant, Vapours, Rubbery polymers, Glassy polymers, Permeation of Liquids, Solution and Diffusion of Water in Polymers, Permeability of Penetrant Mixtures, Transport of Dissolved Gases, Transport of Solute Penetrants, Heterogeneous Media, Laminates, Crystalline Polymers, Filled Polymers, Dispersion of one Polymer in a Continuum of Another, Theory of Maxwell, Theory of Rayleigh and de Vris, Theory of Bruggeman, Theory of Higuchi, Pearceâ€˜s Empirical Equation, Comparison with Experiment, Permeability of Films Cast From Latex Dispersions

3. ACRYLIC FABRICATION

Band Saws, Drilling, Sanding and Polishing, Chips and Cracks, Cleaning, Solvent Cementing

4. REINFORCEMENTS FOR THERMOSETS

Laminate Composition, Reinforcements for Filament Winding, Fiberglass Technology , High Strength, Heat and Fire Resistance, Chemical and Weather Resistance, Moisture Resistance, Thermal Conductivity, Electrical Properties, Dimensional Stability, Making Glass Fibers, Glass Composition, Glass Fabric Construction and Weaves, Fabric Count, Weave, Finishes and Finishing, Applications, Electrical, Reinforced Plastics, Coated Fabrics, Scrims, Filtration, Kevlar 49, Yarn Properties, Density, Tensile strength, Modulus, Chemical resistance, Textile processability, Flammability, Temperature resistance, Epoxy Composites, Specific tensile, Specific modulus, Processability, Environmental stability, Flammability, Impact strength, Specific compressive strength

5. MISCELLANEOUS THERMOPLASTIC PROCESSES

Plastisol Molding, Heat Sealing, Calendering, Welding Plastics, Engraving Plastics, Carving Plastics, Rotational Molding, Edge Lighting, Hot Staking, Thermoforming

6. MISCELLANEOUS THERMOSET PROCESSES

Potting, Encapsulation, and Casting, Casting Applications, Filament Winding, Winding Patterns, Resin Systems, Tape Wrapping, Spray Up, Continuous Pultrusion, Embedding with Polyester Resin, Helpful Hints, Adhesive Repairs for Shop and Home, Repair of Plastic Eyeglass Frames

7 COMPRESSION AND TRANSFER MOLDING

Compression Molding, Molds, Compression Presses, Fastening the Mold, Closing and Opening the Mold, Heating the Mold, Types of Compression Molding, High-pressure Compression Molding, Molding Materials, Bulk Factor, Preforms and Preheating, Degassing, Molding Sequence, Molding Pressure, Estimating the Weight of Material Needed, Types of Molds, Advantages of Compression Molding, Limitations of Compression Molding, Solving Molding Problems (High-pressure Molding), Mold Sticking, Dull Surface, Blistering, Warping, Cracking, Unfilled Mold, Weak Moldings, Orange Peel, Pitted Surface, Burn Marks, Poor Electrical Properties, Transfer Molding, Plunger Molding, Advantages of Transfer Molding, Limitations of Transfer Molding, Low-pressure Compression Molding, Premix Molding, Preform Molding, Smc Molding, Molding Problems (Polyesters)

8 DISCIPLINED PROCESS STATEGY FOR INJECTION MOULDING

Abstract, Preface, Temperature, Time, Pressure, Injection Rate, Cooling Rate, Comprehensive, Economical in time, Simple to do, Provide Qualitative results, Easy to interpret, Background, Spc Step One - Raw Material, Single Step Measurement:, Time Dependent Sampling :, SPC

Step Two - Material Handling, Drying:, Blending:, SPC Step Three - Injection Molding, Weight , Operator , Primary Problem, SPC Step Four - Implementation, Management Support , Resources , Patience , Priority , Developments At Eastman Kodak Co, Discussion of Shrinkage/Time, Caveats, Example of Mode #2 Usage -process Analysis, Long Term Analysis, Raw Materials , Materials Handling , Inappropriate Operator Adjustments, Environmental/Utilities Changes , Short Term Analysis, Cycling Temperature Controllers , Worn Non-return Valves , Variability Evaluation of Figure 3, Benchmark For Process â€œGoodnessâ€•, Benchmark Evaluation of Figure 3, Summary, The Mold Must Exhibit an Acceptable Degree of Mold Balance., Overall level of unbalance, Quantitative identification of the most troublesome cavities , Reduce the second stage, Reduce the Boost Timer , Save ten (10) short shots in series, Separate the parts by cavity number and weight, ANALYSIS, Arrange the weights in descending order, Compute the weight differences , Normalize this weight difference , Plot this normalized difference, Evaluation, Action, Variables, Response, Preparation, Generating The Curves , Analysis, Time Procedure, Time Analysis, Pressure Procedure

9. INJECTION MOLDING, BLOW MOLDING, EXTRUSION

Injection Molding, Injection Molding Machines, Injection Unit , Mold Clamping Unit , Preheating and Predrying, Pellet Geometry, Lubrication, Mold Surface Temperature, Injection Pressure, Feed Cushion, Plunger Forward Time, Molding Cycles, Molding Shrinkage, Dimensional Tolerances, Screw Plasticization In Injection Molding, Screw Design, Screw Drive Characteristics, Nonreturn Valves, Cylinder Temperature Control, Screw Back Pressure, Screw Speed, Rate of Injection, Injection Mold Design, Basic Design Considerations, Functions of the Mold Components, Sprue Bushing, Runners, Gates, Cavity, Force, and Mold Cores, Venting, Water Channels, Ejector Mechanisms, Molding Problems, Blow Molding, Extrusion-Blow Molding, Molds, Finishing Containers, Extrusion

10. NEWLY DEVELOPED INJECTION MOULDING TECHNOLOGY

Introduction, Horizontal Screw Type Injection Moulding Machine, Vertical Screw Type Injection Moulding Machines, Other special purpose injection moulding machines, Further developments

11. INJECTION MOULDING

Introduction, Basic Principles of Injection Moulding, Correct injection speed is necessary for filling the mould, Plastic melt should not suffer degradation, The mould must be controlled for better quality product, Logical consideration of moulding profile and material is important than standard setting guide lines, Economical setting of the machine., Proper maintenance of machine;, Safety Operations., Preliminary Checking for Moulding, Material, Component, Mould, Machine, Injection Moulding Technique, The Various Type of Injection Moulding Machines are., Specifications, Platen Mounting of Moulds, Locating Spigots, Mould Clamping, Press Capacity, Shot Capacity, Plasticizing Capacity, Clamping Force, Injection Pressure, Ejection Force, Mould Cooling, Water Cooling, Air Cooling., Oil Heating/Cooling., Mould Cooling Time, Melt Processing, Equipments For Injection Moulding, Heating Cylinder, Nozzle, Non-Return Valve, Adapter, Screw, Cylinder Temperature, Injection Rate, Clamping Force, Start Up And Shut Down Procedures, Start Resin Change/Purging, Temporary Shut Down, Normal Shut Down, Start Up After Emergency Shut Down, Cylinder Temperature, Thermal Stability of Acetals, Back Pressure, Injection Pressure, Injection Rate, Moulding Cycle, Calculation of cycle time, Mould Temperature, Reground Resin, Economical Production of Parts, Quality Parameters of the Part, Periodic Inspection of Equipment Operations, Start Moulding on the Established Cycle, Keep Low Mould Open Time, Minimize Injection Time, Maximize Injection Pressure, Reduce Hold Time, Adjust Mould Temperature Controller, Minimize Screw Forward Time, Operation On New Cycle, Enter New Cycle In Records, Resin Supply, Mould Operation, Mould Temperature Control, Mould Venting, Mould Runner System, Safety Precautions For Moulding Acetal Resins, Mould Shrinkage, Post Moulding Shrinkage, Annealing of Mouldings, Annealing Procedure, Cooling Procedure, Environmental Changes, Thermoplastic Materials, Thermosetting Materials And Elastomers

12. THE PLASTIC INJECTION MOULDING ENVIRONMENT IN INDIA

Introduction, A Deeper Look in the Problem, Change in the Moulding Shop -the Five M, Material, Machine, Mould, Man

13. TIEBARLESS AND 2-PLATEN INJECTIO MOULDING MACHINES

Trendspotting, Trendsetting, The Tiebarless Machine, The 2-Platen Machine, Further Trends

14. THIN WALLED INJECTION MOULDING

Definition of Thin Wall, Classification of parts, Examples of Small thin - wall pans, Examples, of partially thin- wall parts, Other examples :, Evaluation of Production Cost, Factors to be considered in evaluating the cost performance -, Shortening of Cycle Time is one of the Key Points having Direct Influence on the Production Costs, Benefits of Thin Wall Moulding, Material Saving, Reduction in Shot Weight and Cycle Time, High Productivity, Energy Saving, Compact Size, Ease In Recycling, Higher Return of Investment, Factors of Flowability, Ratio of length to thickness , Viscosity, Melt Index (MI), Melt flow rate (MFR) of material, Machine total Performance, Mould & Machine Requirement For Thin Walled Injection Moulding, Mould Requirement:, Moulding Machine Requirement :, SG Series Injection Moulding Machines From Sumitomo Heavy Industries are Perfectly Suitable for Thin Walled Injection Moulding, How The SG Series Scores Over Ordinary Machines, Ordinary Machine, Main Responce , Remedy , SG Series Machines

15. MOLD COOLING BEST BET FOR HIGH PROFITS

General, Cooling in new moulds, Coaling in existing moulds, Cooling drawings, No cooling, Poor cooling, Better cooling, Excellent cooling , Costs, New moulds, Existing moulds, Chiller, Insulated chiller plumbing, Presses, Financial analysis, Benefits, Step by step investment, Spreadsheet, Shorter cvcle times, Flash reduction, Profit gains, Other benefits, Summary

16. GAS INJECTIONMOULDING

TECHNOLOGY

In summation, A Lower Cost, Higher Quality Product, Multiple-Polymer Injection Moulding, Definition, Two-shot moulding processes, Two-Polymer Injection Moulding Process, Composite Injection Moulding (Combiform), Multi-Components Injection Moulding Process, Innovative Applications, Two-Polymer Injection Moulding, The wet room power outlet socket, Rear light, Composite Injection Moulding (Combiform), Two-material bumper, Automotive cover with seal lip, Washing machine cover, Multi-Component Injection Moulding , Paper sorter , Cover, Gas Assisted Injection Moulding Process, The Airmould Process - different from other gas assisted injection moulding processes, What advantages does the Airmould Process offer to the Injection Moulder ?, Rod shaped mouldings, The Airmould system - a modular system, Pressure generating units with and without gas recovery, Gas Pressure Control, Gas Injection, Door Handle, Cover for copy machine, Co-Injection and Airmould, Conclusions

17DESIGN

Introduction, Product Design, Functional Importance of the Component, Properties of Plastic Raw Materials and its Behaviour, Stiffness and Rigidity, Toughness, Maximum Use Temperature, Recovery from Deformation, Distortion and Internal Stresses, Processing of Plastics, Economical and Psychological Factors, Similar Products, Preparation of Prototype and Part Drawing, Fundamentals of Mould Design, Type of Mould and Construction, Arrangement of Flash Faces, Line of Draw, Gate, Runners and Feed, Component Retention, Number or Impression and Arrangement, Extraction of Component, Component Tolerance, Range of Shrinkage, Mould Draft, Wear and Tear of Part Forming Elements., Manufacturing Tolerance, Wear and Tear of Elements., Clamping Force, Estimation of Moulding Cycle and Part Cost, Possible Problems and Solutions

18. PRINCIPAL TYPES OF INJECTION MOULDS

Hand Injection Moulds, Single Cavity Two Plate Moulds, Multi - Cavity Moulds, Three Plate Moulds, Multi - Colour Moulds, Hot-Runner Moulds, Advantages of hot-runner moulding system., Manifold system, Heating systems, Integrally heated sprue bushings, Internally heated bushings, Externally heated bushings, Valve gates

19. MOULD MATERIALS AND PROCESSING METHODS

Introduction, Normalizing, Stress-relieving, Stabilizing, Stabilizing after welding with H13 filler rod, Pre-heating, Hardening, Quenching, Tempering, Annealing for re-hardening, Sub-zero Treatment., Mould Machining, Characters and Logo marking, Mould Polishing & Finishing, Photo Engraving, Mould Materials and Die Life

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NIIR PROJECT CONSULTANCY SERVICES, 106-E, Kamla Nagar, New Delhi-110007, India.
Email: npcs.india@gmail.com **Website**: NIIR.org

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