Plastic Extrusion, Moulding and Mould Designs

Plastics extrusion is a high-volume manufacturing process in which raw plastic is melted and formed into a continuous profile. Extrusion produces items such as pipe/tubing, weather stripping, fencing, deck railings, window frames, plastic films and sheeting, thermoplastic coatings, and wire insulation.
This process starts by feeding plastic material (pellets, granules, flakes or powders) from a hopper into the barrel of the extruder. The material is gradually melted by the mechanical energy generated by turning screws and by heaters arranged along the barrel. The molten polymer is then forced into a die, which shapes the polymer into a pipe that hardens during cooling.
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.
Market Outlook

Injection Molded Plastic Market size was calculated at over 100 million tons in 2015 with growth forecast at more than 5% CAGR up to 2023.
The global market for injection molded plastics is expected to reach $277.78 billion by 2020.
Plastic Consumption by Application (India)

- Packaging: 24%
- Electronic: 16%
- Agriculture: 23%
- Transportation: 4%
- Furniture: 1%
- Houseware: 10%
- Others: 14%
- Building: 8%

Total: 100%
Import-Export of Plastics (In ‘000 MT), FY14

- **PE**: Import = 1331.3, Export = 126.1
- **PP**: Import = 479.2, Export = 943.2
- **PVC**: Import = 1208.5, Export = 1.3
- **PS + EPS**: Import = 41.7, Export = 88.0
- **Others**: Import = 64.7, Export = 10.2

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NPCS
The growth rate of the Indian plastics industry is among the highest in the world, with plastics consumption growing at 16% per year (compared to 10% p.a. in China and around 2.5% p.a. in the UK). Considering a growing middle class (currently around 50 million) with low per capita consumption of plastics (currently 9.7kg per head), this high growing rate is likely to continue, as the per capita consumption of plastics will inevitably increase.
1. PREPARATION OF PLASMA FILMS

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, Pearces 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

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

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 STRATEGY 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,
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 Goodness — 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,
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,
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 INJECTION 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, Cooling 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 cycle times, Flash reduction, Profit gains, Other benefits, Summary
16. GAS INJECTION MOULDING 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
17. DESIGN

• 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,
18. PRINCIPAL TYPES OF INJECTION MOULDS

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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