American Injection Molding Institute

Plastics Technology & Engineering

Learning Objectives – Plastic Materials

1) Recognize the manner in which various polymers are polymerized and how chemical structure affects the properties of the polymers, such as environmental considerations, processability and overall physical performance.

2) Identify various methods used to study and report data on polymer rheology and relate them to the terms used to describe it, such as shear rate, shear stress, and viscosity.

3) Recognize common commercial polymers as either semi-crystalline or amorphous (including elastomers) while being able to identify common characteristic differences between the classifications and analyze how the structural differences impact rheology, processing, and physical properties of a molded part.

4) Understand stress and strain relationships/graphs and the impact on the polymer properties. Recognize the practical aspects of viscoelastic behavior and other long-term time-temperature performance characteristics of a polymer, such as creep and stress relaxation in the solid state.

5) Identify the critical aspect of molecular weight and molecular weight distribution; their influence on both processing and end-use performance; identify practical methods for measuring molecular weight and how to interpret the results of these tests.

6) Identify the key uses of additives in modifying polymer properties and describe their impact on such items as shrinkage and warpage and while preventing other certain mechanisms that may compromise end-use polymer performance.

7) Interpret traditional material data sheets by analyzing the information and relating it to how the physical tests are performed, along with being able to convert units as needed.

8) Analyze and breakdown the various potential root causes of plastic part warpage due to variations in shrinkage, both volumetric and orientation induced.

Learning Objectives – Mold Design

1) Analyze mold cooling systems and components and identify ways to improve the uniformity and efficiency of removing heat from the molded part.

2) Recognize the primary mold components, and recall key considerations, for ejecting plastic parts and runner systems.

3) Identify various machining operations/machines, mold types and recall the purpose and key considerations for each of the five primary mold systems and associated components and design considerations.

4) Recognize how complex melt flow conditions develop during molding and describe the interdependency between those material properties, and the injection process and the design of the melt delivery system.

5) Recall and explain key plastic shrink and warp considerations.

6) Recall the various gate styles and explain the influence that gating location(s) have on part quality and manufacturing efficiency.

7) Analyze the melt delivery system of injection molds and evaluate how its design impacts the molded part quality and manufacturing efficiency.

8) Analyze and solve engineering, strength of material, problems related to the structural integrity of injection mold plates and components.

9) Identify the primary elements of a mold vent, analyze mold design and plastic flow to identify where vents should be placed, and recognize the relationship between a plastic materials classification, viscosity and its impact on the recommended vent depth.

10) Recognize the importance of designing for assembly and recall key considerations for preventing component installation errors.

Learning Objectives – Injection Molding

1) Evaluate current industry processing standards and determine what practices are beneficial and recognize the impact that the process inputs have on the process outputs and molded part.

2) Demonstrate a recognition of and application for alternate methods of injection molding.

3) Recognize commonly used terminology and componentry utilized in injection molding.

4) Evaluate and determine if a given molding machine is adequate for a specific part and mold.

5) Determine how to properly manage, prepare, and cool plastic materials throughout the injection molding process.

6) Analyze the phases of the injection molding process and determine the appropriate machine settings are for each phase.

7) Analyze process documentation and historical run data in order to strategically troubleshoot the molding process.

8) Analyze graphical representations of the molding process for information and troubleshooting purposes.

9) Apply Flow Grouping Methodology and utilize it in a scientific manner to optimize process control.

10) Analyze the impact that the material, mold design, and part design have on the molding process and the molded part quality.

Learning Objectives – Part Design

1) Design injection molded plastic parts for manufacturability considering the complex interdependencies of the design, the polymer material, mold and the injection molding process.

2) Interpret mechanical polymer material data including complex viscoelastic, non-linear and environment dependent properties, as applied to injection molded plastic parts.

3) Identify appropriate plastic materials for a defined application considering both performance and cost requirements.

4) Interpret and apply Plastic Part Design Guidelines considering manufacturability, performance and stability of the injection molded plastic part.

5) Evaluate and recommend plastic part assembly methods.

6) Design plastic parts for structural applications considering the complex viscoelastic, non-linear and temperature dependent properties of plastic materials.

7) Evaluate and recommend decoration options for injection molded plastic parts.

8) Interpret, critique and analyze injection molding simulation results of injection molded plastic parts.