CORE CONCEPT

Polymer Characterisation and Testing Laboratory Course: MFI, Rheology, DSC/TGA, GPC and ESCR

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Introduction:

Polymer characterisation and testing laboratory work on MFI, rheology, DSC/TGA, GPC and ESCR is the focus of this 1-week course for resin quality control, application laboratory and technical service units, ending with a Resin Grade Release Testing Plan for a case organisation. Producers lose shipments and customer confidence when melt flow, molecular weight or stress cracking results disagree between the plant laboratory and the converter. Nominees already prepare specimens or run polymer test instruments, and the course is taught through case studies on thermograms, chromatograms, flow curves and certificates. CoreConcept Training Center delivers this polymer characterisation and testing laboratory course.

Course Objectives:

- Measure melt mass-flow rate, melt volume-flow rate and flow rate ratio to ASTM D1238 and ISO 1133 for polyethylene and polypropylene grades
- Interpret capillary and rotational rheometer flow curves, shear thinning and complex viscosity to separate grades with equal melt flow
- Run DSC and TGA scans to report glass transition, melting, crystallinity, oxidation induction time and filler or ash residue
- Determine Mn, Mw, Mz and dispersity by high-temperature GPC and relate PET intrinsic viscosity and PVC K-value to grade targets
- Prepare compression-moulded plaques and conditioned bars and perform tensile, flexural, notched impact and ESCR tests on resin samples
- Validate polymer test methods through repeatability and reproducibility studies and resolve certificate-of-analysis disputes with converters

Target Audience:

- Resin quality control laboratory units responsible for testing production lots and releasing certificates of analysis
- Application laboratory units responsible for evaluating grade performance in film, pipe, bottle and moulding trials
- Polymer testing technicians responsible for moulding specimens and operating melt flow, thermal and mechanical instruments
- Analytical chemists responsible for molecular weight distribution and thermal analysis of polyolefin, PET and PVC samples
- Technical service units responsible for answering converter complaints with laboratory evidence

Course Outline:

Day 1: Polymer Structure Signals and Laboratory Sampling for Resin Grades

- Molecular Weight, Branching and Comonomer Effects on Measured Properties
- Polyolefin, PET and PVC Grade Specification Sheet Review
- Pellet and Powder Sampling Plan From Silo and Bagging Lines
- Moisture Drying Protocols for PET and Hygroscopic Resin Samples
- Laboratory Test Matrix Current-State Review for Grade Release

Day 2: Melt Flow, Density and Melt Rheology Methods

- ASTM D1238 and ISO 1133 Melt Flow Rate Procedure
- Melt Volume-Flow Rate and Flow Rate Ratio Calculation
- ISO 1183 Density by Immersion and Gradient Column
- Capillary Rheometer Flow Curves and Shear Thinning Analysis
- Rotational Rheometer Frequency Sweep and Complex Viscosity Plots

Day 3: Thermal Analysis and Molecular Weight Distribution Practice

- DSC Heat-Cool-Heat Programme for Melting and Percent Crystallinity
- PET Intrinsic Viscosity and PVC K-Value Solution Methods
- Oxidation Induction Time Isothermal Test for Antioxidant Stability
- TGA Mass-Loss Curves for Filler, Ash and Carbon Black
- High-Temperature GPC With Trichlorobenzene and Polystyrene Calibration

Day 4: Mechanical Properties, ESCR and Method Validation Problems

- Compression-Moulded Plaque Preparation and Specimen Conditioning Records
- ISO 527 Tensile and ISO 178 Flexural Testing of Plastics
- ISO 179 Charpy and ISO 180 Izod Notched Impact
- ASTM D1693 Bent-Strip ESCR With Igepal Solution
- Repeatability and Reproducibility Study With Round-Robin Resin Samples

Day 5: Case Study on a Resin Grade Release Testing Plan

- Case Melt Flow and GPC Discrepancy Between Two Laboratories
- Case DSC and TGA Evidence for an Off-Grade Lot
- Case ESCR and Impact Failure Behind a Converter Complaint
- Certificate-of-Analysis Dispute Response Pack for a Converter
- Resin Grade Release Testing Plan Completion and Peer Review

Skills You Will Gain:

- Melt Flow Rate Measurement
- Polymer Melt Rheology Interpretation
- Thermogram Reading for Resins
- Molecular Weight Distribution Analysis
- Plastics Specimen Preparation
- Stress Cracking Resistance Testing
- Polymer Test Method Validation
- Certificate-of-Analysis Dispute Handling

Why Attend This Course:

- Deliver a Resin Grade Release Testing Plan for a case organisation to the quality control laboratory head and the technical service manager
- Decide whether an out-of-range melt flow, crystallinity or impact result reflects the lot or the test procedure before a grade is released
- Prevent rejected shipments, repeat testing and lengthy converter claims caused by unvalidated methods or poorly conditioned specimens
- Coach laboratory colleagues on plaque moulding, DSC programmes, GPC calibration and ESCR set-up using the worksheets built during the course

Conclusion:

Back at the plant, the participant hands the Resin Grade Release Testing Plan to the quality control laboratory head and the technical service manager. The laboratory uses it to set which melt flow, rheology, thermal, molecular weight and mechanical tests release each polyolefin, PET or PVC grade, the acceptance limits and the retest rules. Technical service uses its dispute pack when a converter questions a certificate. After the first quarter of releases under the plan, the unit should review retest rates, interlaboratory differences and complaint outcomes, then tighten limits or methods.

Frequently Asked Questions FAQ:

What should participants know before a polymer characterisation and testing laboratory course?

Participants should already prepare specimens, run melt flow, thermal or mechanical instruments, or review resin test results. Bringing anonymised grade specifications, a recent certificate of analysis and sample thermograms or GPC reports helps them apply the case studies to their own laboratory.

How does a polymer characterisation and testing laboratory course differ from a polymer processing and extrusion course?

It stays inside the laboratory, covering how resin properties are measured, validated and reported for grade release. Processing courses address screws, dies, moulding settings and line defects, and management system courses address laboratory documentation rather than the test methods themselves.

Why can two polymer grades with the same MFI behave differently in a polymer testing laboratory and on a converter line?

Melt flow is a single-point measurement that reflects average molecular weight. Grades with equal melt flow can differ in molecular weight distribution, long-chain branching and shear thinning, which rheology sweeps and GPC reveal and which change bubble stability, sag and impact behaviour.

What do participants take back from the polymer characterisation and testing laboratory course?

Participants take back a Resin Grade Release Testing Plan for a case organisation, with a test matrix per grade, a DSC and GPC worksheet, a specimen conditioning checklist, a repeatability study template and a certificate-of-analysis dispute response pack.