CEF

CRYSTALLIZATION ELUTION FRACTIONATION

An innovative and powerful approach for Chemical Composition Distribution Analysis.

Crystallization Elution Fractionation (CEF) is a new approach for measuring Chemical Composition Distribution (CCD) in polyolefins by combining CRYSTAF and TREF separation mechanisms. The instrument includes the capability of performing TREF and TGIC* techniques.

CEF is a simple and reliable apparatus, requiring an injection valve, a packed column, a pump, and an IR detector. The autosampler, attached to the CEF oven, takes care of sample dissolution in vials of 10 or 20 mL. The instrument can analyze up to 50 samples a day with disposable glass vials.

The virtual instrumentation software controls the full process; therefore, no manpower is required. At the end of each sample analysis, the lines and the column are rinsed and CEF will continue with the analysis of the next sample in the queue.

The concentration of the sample is measured by an Infrared detector (IR4 or IR5 from Polymer Char), which also provides information about its comonomer content. More information on molar mass composition interdependence can also be obtained by adding a Viscometer detector.

Optionally, the TREF column can be replaced by a TGIC* column in order to separate by adsorption and reach the composition range of elastomer resins.

*Thermal Gradient Interaction Chromatography analysis of Polyolefins on a graphitized carbon column is a patented technology by DOW Chemical.

Polymer Char References
· App. Note: "Crystallization Elution Fractionation: A New Approach to measure the Chemical Composition Distribution in Polyolefins." LCGC Europe 2011, 18-19.
· Article: "Crystallization Elution Fractionation. A New Separation Process for Polyolefin Resins." Macromolecular Symposia 2007, 257, 71-79.
· Article: "Advances in Crystallization Elution Fractionation." Macromolecular Symposia 2009, 282, 14-24.
· Article: "Crystallization Elution Fractionation and Thermal Gradient Interaction Chromatography Techniques Comparison." Macromolecular Symposia 2012, 312, 115-129.
· Article: "Advances in Thermal Gradient Chromatography and Crystallization Techniques for Composition Analysis in Polyolefins." Macromolecular Symposia 2013, 330, 9-21.
· Article: "Separation of Ethylene-Propylene Copolymers by Crystallization and Adsorption Mechanisms. A Journey Inside the Analytical Techniques. Macromolecular Symposia 2015, 356, 147-166.

Find out more at **www.polymerchar.com/CEF**
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KEY FEATURES

▸ Fully automated CEF, TREF and TGIC* techniques (CCD measurement):
  ‣ No manpower required.
  ‣ No handling of solvents.
  ‣ Low solvent consumption.
  ‣ Automated rinsing at the end of the analysis.

▸ Subambient operation (down to -20ºC) for low crystallinity samples.

▸ 42 samples can be analyzed sequentially and automatically with analysis time as short as 30 minutes per sample for high throughput analysis or as long as desired for high resolution analysis.

▸ Easily interchangeable Infrared Detectors; IR5 MCT for outstanding sensitivity in concentration and composition, and IR4 with carbonyls capability.

▸ Possibility of adding a Viscometer detector.

▸ Excellent reproducibility.

▸ Possibility of performing TGIC* by exchanging the column.
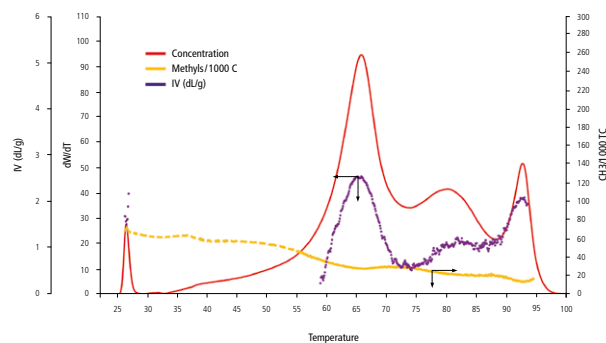
Trimodal LLDPE sample analyzed by CEF with IR5 Concentration and Composition, and Viscometer Detectors

Polymer Char

Solutions for Polyolefin Characterization

CRYSTAF: An instrument designed for intensive use in the analysis of the Chemical Composition Distribution in Polyolefins.

TREF: A completely automated apparatus for the analysis of the Chemical Composition Distribution in Polyolefins. It provides complementary information to CRYSTAF data in the analysis of some complex resins.

CRYSTAF-TREF: CRYSTAF and TREF techniques are available in the same equipment for a full Chemical Composition Distribution characterization.

CEF: A high throughput equipment to analyze the Chemical Composition Distribution in Polyolefins, using a new approach combining CRYSTAF and TREF separation mechanisms.

PREP mc²: An automated instrument to perform semipreparative fractionation according to composition by TREF or CRYSTAF, or molar mass.

PREP C20: New column-based preparative fractionation instrument, capable to fractionate up to 20 grams of polymer.

CRYSTEX® QC: A truly automated system based on TREF-separation concept for soluble fraction measurement, ethylene content and intrinsic viscosity in PP/PE plants control.

CRYSTEX® 42: A high-throughput and easy-to-use system for simultaneous measurement of the soluble fraction, ethylene content and intrinsic viscosity in a fully automated process for up to 42 samples.

IVA: Reliable and automated instrument for Intrinsic Viscosity Analysis of polymers with dissolution temperature up to 200ºC.

GPC-IR®: Advanced High Temperature GPC for the analysis of Molar Mass Distribution in Polyolefins. Fully automated sample preparation and filtration. Triple detector (IR, VS, LS) plus composition.

GPC-QC: High Temperature GPC instrument for Quality and Process Control in Polyolefin production plants.

CFC: A fully automated Cross Fractionation Chromatograph (TREF x GPC or TGIC x GPC) for the analysis of Bivariate distribution.

GPC One® Software: The most comprehensive GPC/SEC Calculations Software integrating all detectors' signals.

Data Unit 200: Versatile signals acquisition device to link any vendor GPC instrument with Polymer Char's GPC One®.

TGIC: An adsorption high temperature HPLC technique for the analysis of low crystallinity Polyolefins.

SGIC 2D: An adsorption high temperature HPLC technique combined with GPC and infrared detection for the analysis of composition and molar mass interdependence of Polyolefin resins.

IR4: Integrated, reliable and simple to use infrared (IR) detector to measure concentration and composition.

IR5 MCT: Integrated and modern IR detector with an MCT element (thermoelectrically cooled) for high sensitivity analysis.

Analytical Services: Polymer Char laboratory, a global reference in the field, counts on the latest technologies for Polyolefin Characterization.

Company Profile

Polymer Char is devoted to the development of state-of-the-art instrumentation for Polyolefin Analysis.

The company offers the broadest and most modern range of instruments and services for polymer analysis and more specifically, for the structural characterization of Polyolefins, such as Molar Mass Distribution (GPC-IR®, GPC-QC, GPC One®), Chemical Composition Distribution (CRYSTAF, TREF, CEF), Bivariate Distribution by Cross-Fractionation Chromatography (CFC), High Temperature HPLC (TGIC, SGIC 2D), Soluble Fraction Determination (CRYSTEX®, CRYSTEX® QC and CRYSTEX® 42), Preparative Fractionation (PREP mc², PREP C20), Intrinsic Viscosity (IVA) or integrated Infrared Detection (IR4, IR5 MCT).

Polymer Char is also well known for its advanced approach to virtual instrumentation software that, together with excellent remote control capabilities and its strong commitment to Customer success, places the company at the leading edge on instrumentation diagnostics and technical support.

Together with its global network of partners and distributors, Polymer Char supplies, trains and supports Customers worldwide. The company provides analytical services in 35 countries and its instruments are present today in over 20 countries within the Americas, Europe, Africa, Middle East and Asia Pacific, predominantly serving Polymer Producers and Processors, Government and Academic Research Laboratories, Contract Research Organizations, Analytical and Testing Laboratories, and Chemical Instrumentation Manufacturers.

In the last two decades and with an annual investment of up to 20% of its manpower resources on R&D, Polymer Char has played a key role in the development of most of the existing Polyolefin analysis technologies, such as CRYSTAF, CRYSTEX®, CEF, CFC, and GPC with IR detection. Each new project, each new analysis, underpins Polymer Char as the Polyolefin Characterization Company.