

# 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 42 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 IR6 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

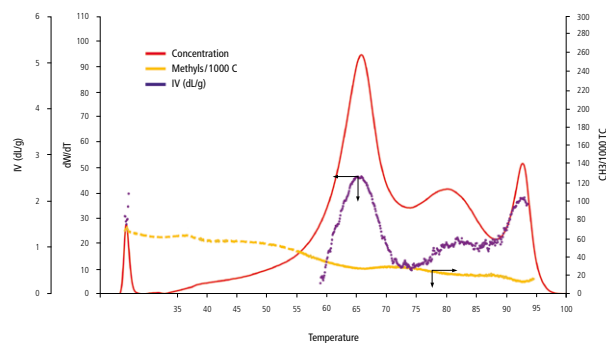
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Find out more at [www.polymerchar.com/CEF](http://www.polymerchar.com/CEF)

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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 -15°C) 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.
- ▶ 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

## Solutions for Polyolefin Characterization

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

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

**PREP mc<sup>2</sup>:** 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<sup>®</sup> 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<sup>®</sup> 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 polyolefins at high temperature.

**IVA Versa:** Fully automated instrument for Intrinsic Viscosity Analysis of polymers at ambient temperature.

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

**GPC-IR<sup>®</sup>:** Advanced High Temperature GPC for the analysis of Molar Mass Distribution in Polyolefins and other polymers. 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 (TREFxGPC or TGICxGPC) for the analysis of Bivariate distribution.

**One Software:** The most comprehensive Calculations Software integrating all detectors' signals.

**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 of polyolefins.

**IR6:** Integrated and modern IR detector for high sensitivity analysis of polyolefins.

**dRI:** Refractive index detector for GPC-IR.

## 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<sup>®</sup>, GPC-QC), Chemical Composition Distribution (CRYSTAF, CEF), Bivariate Distribution by Cross-Fractionation Chromatography (CFC), High Temperature HPLC (TGIC, SGIC 2D), Soluble Fraction Determination (CRYSTEX<sup>®</sup> QC and CRYSTEX<sup>®</sup> 42), Preparative Fractionation (PREP mc<sup>2</sup>, PREP C20), Intrinsic Viscosity (IVA, IVA Versa) 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 more than 40 countries and its instruments are present today in over 35 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.

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<sup>®</sup>, CEF, CFC, and GPC with IR detection. Each new project, each new analysis, underpins Polymer Char as the Polyolefin Characterization Company.



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