

TGIC

THERMAL GRADIENT INTERACTION CHROMATOGRAPHY



A new and fully automated Thermal Gradient Interaction Chromatograph for measuring Composition Distribution in Elastomers and Low Crystallinity Polyolefin Copolymers.

High Temperature HPLC has become recently available for the analysis of polyolefins, field where it is better known under the name of Interaction Chromatography. It was first used in Solvent Gradient Interaction Chromatography mode (SGIC) and it is today extended with the use of a thermal gradient instead, also known as Thermal Gradient Interaction Chromatography (TGIC).

The TGIC technique using carbon based adsorbents was developed by The Dow Chemical Company to characterize the composition distribution in polyethylene copolymers. This technique requires a cooling (adsorption) and a heating (desorption) step. Elution of the sample takes place in that last heating step, observing a linear dependence of comonomer content to desorption temperatures in a similar manner to TREF and CEF, and being molar mass independent above 20,000 Da.

TGIC will adsorb polymer molecules by the level of molecular surface in contact with the surface of the adsorbent, thus it may discriminate polymers by the level of irregularities in the chain, in a similar approach to crystallization techniques. TGIC, however separates by adsorption and no co-elution is expected.

Resolution in TGIC is lower than in crystallization techniques but it has the possibility to extend the range of polymers to be analyzed towards the amorphous region which is limited by crystallization techniques. Then, the analyses of elastomers and other amorphous polyolefins are the main application of TGIC.

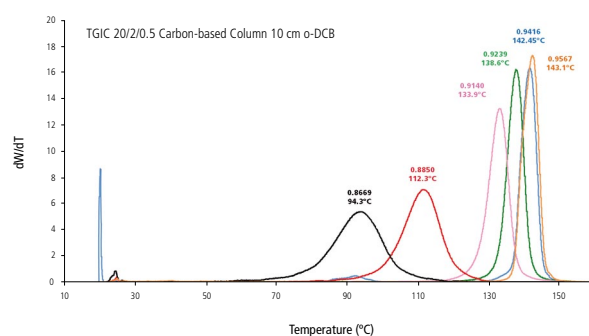
TGIC is performed with a single solvent, typically o-DCB or 1, 2, 4 TCB in a Crystallization Elution Fractionation instrument (CEF) with the standard autosampler, injection system and an infrared detector, only requiring to replace the TREF column by a TGIC column.

Find out more at www.polymerchar.com/TGIC

This information is subject to change without notice. ©2025 Polymer Char.

KEY FEATURES

- ▶ Fully automated operation with no manual solvent handling. Integrated vial solvent filling, sample dissolution and in-line filtration.
- ▶ Fast analysis time of around 2-3 hours including sample dissolution.
- ▶ Analysis of up to 40 samples sequentially, with the possibility of using different methods each one.
- ▶ Both TGIC and CEF analyses can be performed in the same instrument with dedicated software packages.
- ▶ Easy incorporation of Polymer Char's on-line Viscometer for composition-molar mass interdependence.
- ▶ Option to integrate IR6 detector for maximum sensitivity in both concentration and composition signals, and measurement of carbonyl groups.



TGIC analysis of a series of Ethylene Octene Copolymers.

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 200°C.

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 (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.

IR6: Enhanced sensitivity and stability to analyze molecular weight and chemical composition (SCB/1000TC) and the additional capability of measuring carbonyls group in the band of 1740 cm⁻¹.

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, One Software), 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, IVA Versa) or integrated Infrared Detection (IR4, IR6).

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 three 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.



Several Polymer Char's R&D projects have counted on the financial support of IMPIVA, the Spain's Ministries of Science and Innovation and of Industry and Trade; and the European Union, with its Funds for Regional Development within the FEDER operational program of the Valencian Community 2007-2013.