A critical comparative study of HT-TGIC, CRYSTAF and CEF of polyolefins.

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Chemical composition distribution is one of most import microstructural distributions which has a profound effect on performance of polyolefins. The most commonly used methods to determine CCD are: Temperature Rising Elution Fractionation, TREF, Crystalization Elution Fractionation, CEF, and Crystallization Analysis Fractions, CRYSTAF. All these three methods are based on crystallizability of polymer chains in a dilute solution. A relatively recent technique to determine CCD, which is not based on crystallizability, is High Temperature Thermal Gradient Interaction Chromatography (HT-TGIC). This technique relies on adsorption of polymer chains on porous graphitic carbon (PGC, Hypercarb). The retention by graphite from polymer solution is determined by enthalpic interaction of polymer segments with graphite surface. The strength of interaction depends on both the surface area of the polymer segment in contact with graphite surface and upon the nature and type of polymer chains at the point of interaction with the flat graphite surface. In this study, CEF, CRYSTAF and TGIC were conducted on different types of ethylene/α-olefins with different short chain branch densities and different chain lengths and also on blends of ethylene/1-octene copolymers. Different operation conditions were also studied in both CEF and CRYSTAF. Experimental results show that in TGIC peak temperature is linear function of short chain branch density and is almost independent of length of short chain branches. These three methods were also compared by analyzing polymers with complex microstructures. Results show that CRYSTAF and CEF are more powerful than TGIC in exploring polymers with complex microstructures.