

HTmD Branching: Metallocenes

There is a revolution underway in making plastics with metallocene catalysts. Hundreds of millions of pounds of these plastics are now sold annually and many of the products, which are currently produced from other polymers, could soon be converted to metallocene-catalyzed polymers. These new technologies will impact the additives used to stabilise, modify and process these polymers. It has been estimated that within 10 years, over 50% of all polyolefins will be made by using metallocene catalysts creating a new and dynamic environment for resin producers, additive suppliers, compounders, moulders and end users.¹

In order to characterize these polyolefins by liquid chromatography, a high temperature chromatograph must be used in order to solubilize the polymer. Temperatures typically range from 135°-145°C, and the solvent of choice is trichlorobenzene (TCB). With conditions this aggressive, the choice of detectors is critical. In this application note we show the power of results obtained from a High Temperature miniDAWN (HTmD) for a metallocene catalyst.

Figure 1 contrasts the "conformation" plots (generated by the ASTRA software) of the branched metallocene with the linear polyethylene. At a glance, it is obvious that the metallocene is branched since it has a more compact radius for a given molar mass. The PE, on the other hand, shows a slope of 0.57, which corresponds to a random coil.

In this experimental setup, the HTmD was connected to a Waters 150C high temperature liquid chromatograph. The read head of the HTmD fits inside of the 150C's oven, so all temperature control is effected by the 150C. The flow rate was 0.490 mL/min.

In Figure 2, the tri-functional branching is shown graphically by ASTRA. As the molar mass increases, so do the number of branches per molecule. Neither viscometry nor any other analytical method can determine these quantities directly. But with the HTmD connected to a Waters 150C or PL 210, the molar masses, sizes, branching ratios, branching per molecule, and long chain branching, can be determined directly.

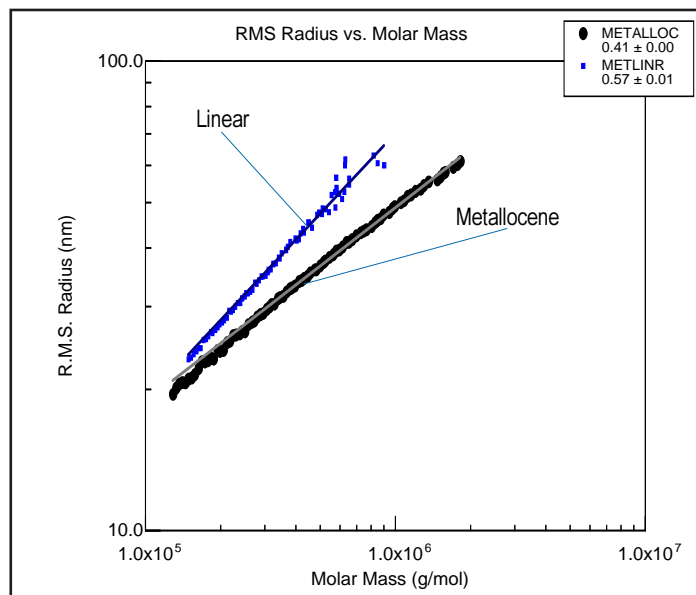


Figure 1. The linear PE sample has a random coil conformation (slope 0.57), while the metallocene sample's slope (0.41) confirms its branched conformation.

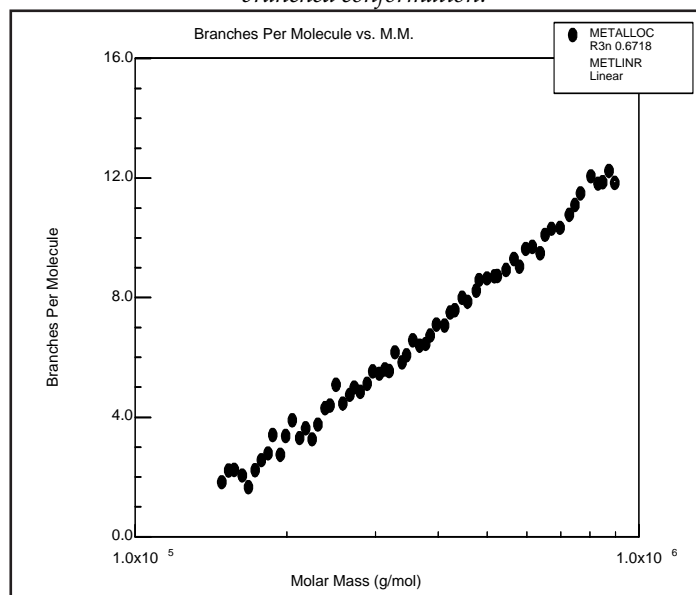
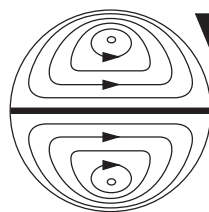


Figure 2. ASTRA software automatically computes the number of branches-per-molecule by comparing the linear sample to the branched one. Here, the trifunctional branching is calculated.

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