

Adhesives and Sealants Raw Materials

Cable Filling/Flooding
Hot-Melt Adhesives
Laminating
Liquid Adhesives
Pressure-Sensitive Adhesives
Roofing
Sealants and Caulks
Urethane Adhesives and Sealants
Wax Blending

GPC Molecular Weight Determinations of *Eastoflex* Amorphous Polyolefins

Eastoflex amorphous polyolefins (APOs) are characteristically saturated, low molecular weight (MW), propylene-based olefin polymers. These products are inherently soft, tacky, and flexible, having broad compatibility with numerous elastomers, polymers, and tackifying resins. This makes them useful for a variety of applications, such as components in adhesive and sealant formulations and as paper laminating adhesives. Their good flexibility and hydrophobic nature make them useful as waterproofing compounds for wire and cable applications as well as asphalt modifiers for modified bitumen roll roofing products.

Eastoflex APOs are typically characterized by properties such as viscosity, softening point, needle penetration, glass transition temperature, and tensile strength. Customers often inquire about the molecular weight (MW) of these products. MW determinations of several *Eastoflex* APOs were obtained by gel permeation (size exclusion) chromatography (GPC).

The weight-average molecular weight (Mw), number-average molecular weight (Mn), and polydispersity index (Mw/Mn) were obtained on a Waters 150C GPC using a refractive index detector and 1,000-, 10,000- and 500-Ångstrom HT columns. The GPC was calibrated with low-MW polyethylene standards, thus the values are relative and cannot be quantitatively compared to other MW determinations.

The following types of APOs were submitted for MW determination: propylene homopolymer, propylene-ethylene copolymers, and homopolymer/propylene-ethylene copolymer blends (mixtures). See Table 1 for MW determinations and polydispersity indices. Mw ranged from about 9,500 to 29,000 and Mn from about 2,900 to 9,100, with Mw/Mn ranging from 3.24 to 4.21. In general, MW increases with viscosity.

Table 1**Molecular Weight Determinations of Eastoflex Amorphous Polyolefins (APOs)^a**

| Formula | Comonomer(s) | Target Viscosity @ 190°C, cP | Wt Avg Mol Wt (Mw) | No. Avg Mol Wt (Mn) | Polydispersity Index (Mw/Mn) |
|---------|--------------|------------------------------|--------------------|---------------------|------------------------------|
| P1010 | — | 1,000 | 14,000 | 3,700 | 3.78 |
| P1023 | — | 2,250 | 19,600 | 5,400 | 3.63 |
| E1003 | Ethylene | 250 | 9,500 | 2,900 | 3.28 |
| D-180S | Ethylene | 500 | 11,500 | 3,100 | 3.71 |
| D-178 | Ethylene | 3,100 | 18,600 | 4,800 | 3.88 |
| E1060 | Ethylene | 6,000 | 23,300 | 6,600 | 3.53 |
| E1200 | Ethylene | 20,000 | 28,700 | 9,100 | 3.15 |
| M1010 | Mixture | 1,000 | 15,100 | 4,000 | 3.78 |
| M1018 | Mixture | 1,750 | 17,300 | 5,200 | 3.33 |
| M1030 | Mixture | 2,900 | 18,300 | 5,000 | 3.66 |
| D-172 | Mixture | 5,800 | 17,500 | 5,400 | 3.24 |

^aThe weight-average molecular weight (Mw), number-average molecular weight (Mn), and polydispersity index (Mw/Mn) were obtained on a Waters 150C GPC that was calibrated with low-MW polyethylene standards. Thus, the values are relative and cannot be quantitatively compared to other molecular weight determinations.

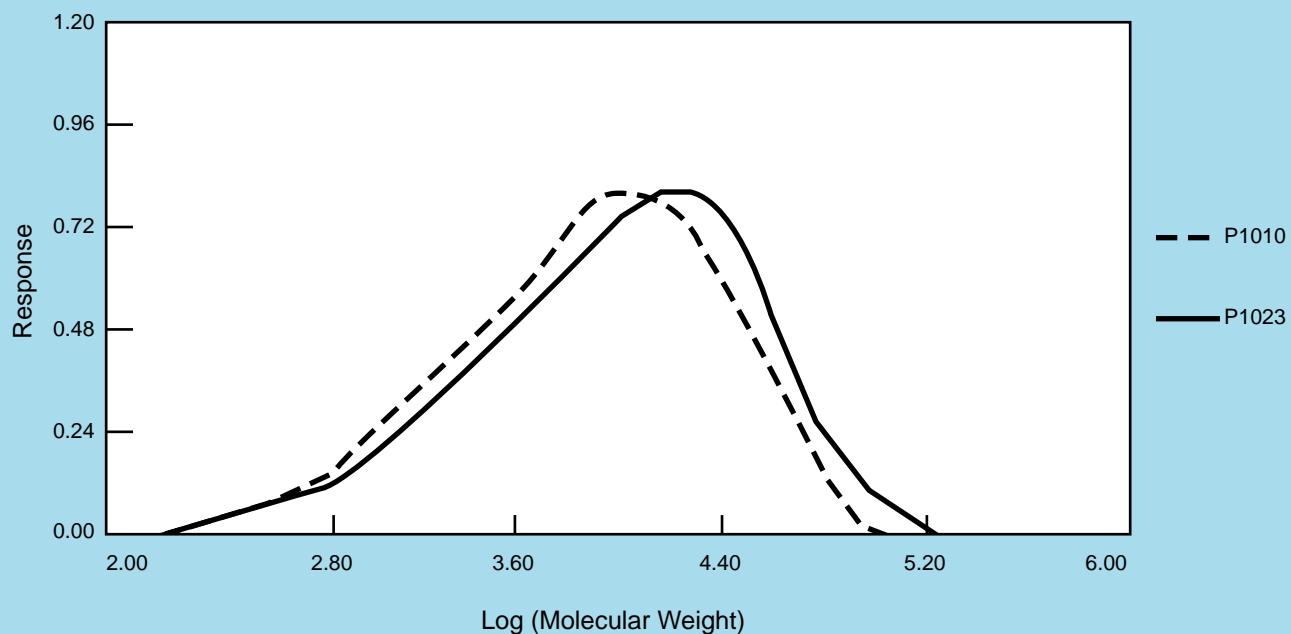
Figure 1**MW Distributions of Amorphous Polypropylene Homopolymers**

Figure 2

MW Distributions of Amorphous Propylene-Ethylene Copolymers

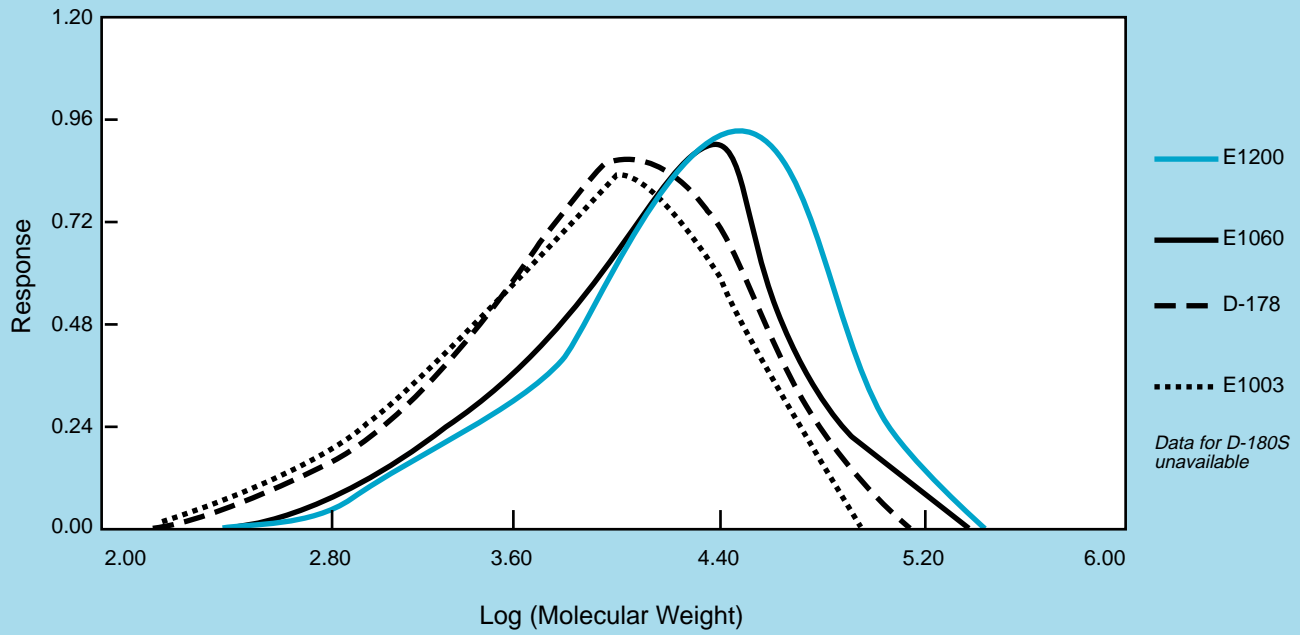
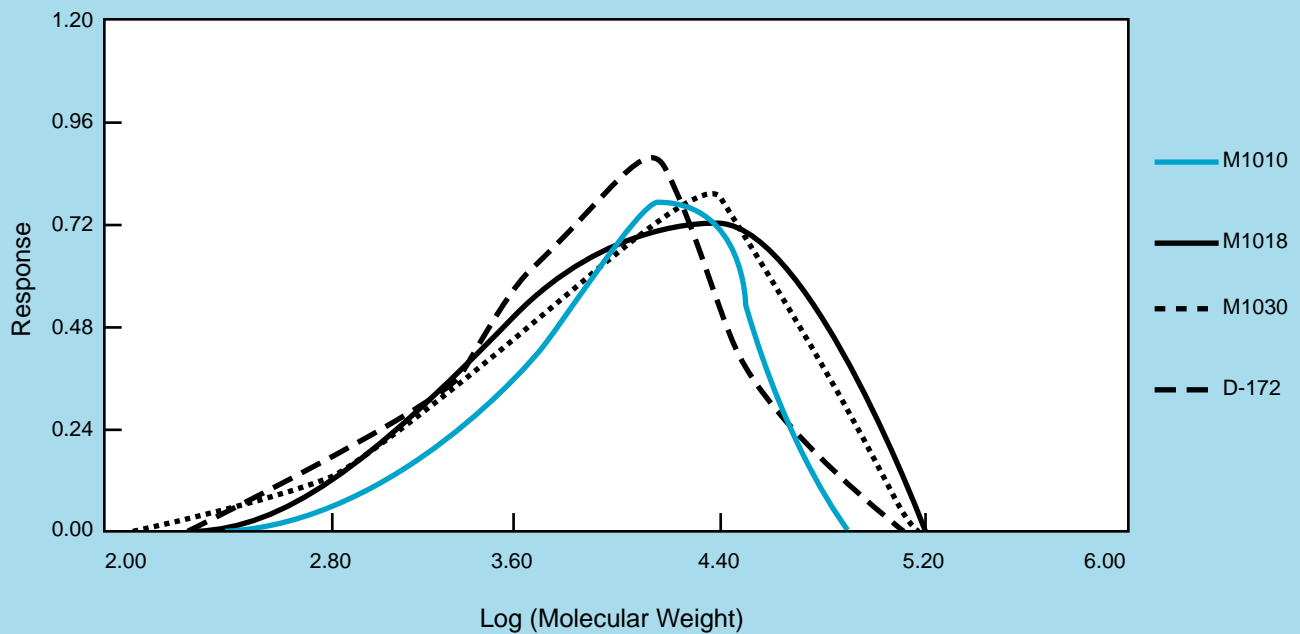


Figure 3

MW Distributions of Amorphous Polyolefin Mixtures



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