Analysis of Poly(isobornyl methacrylate) in Tetrahydrofuran by GPC

Application Note

Materials Testing & Research

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Introduction

Methacrylic monomers have the advantage that they are generally easy to polymerize through simple and well-understood free radical processes. Polymerization is mediated through the vinyl group, leaving the esterified carboxylic group unaffected. As a consequence, it is possible to introduce a wide variety of molecular structures and functional groups to the monomers by coupling different molecules to the ester linkage of the carboxylic group. This has led to the synthesis and commercialization of a huge number of monomers that can be used alone, or in combination, to produce polymers with widely varying physical properties.

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An example of a modified methacrylate monomer is isobornyl methacrylate, shown in Figure 1.

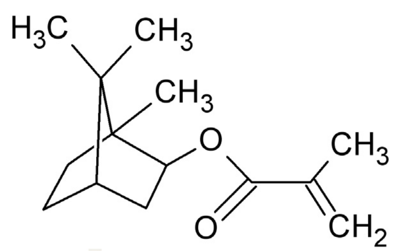

Figure 1. Structure of isobornyl methacrylate monomer

In this species an isobornyl cage has been attached to a methacrylate molecule through esterification. The resulting poly(isobornyl methacrylate) produced by polymerization of the monomer is a hard material with a high glass transition temperature and a high chemical and water resistance, useful properties in the adhesives and coatings industries. Furthermore, isobornyl methacrylate can be used as a reactive diluent for oligomers as the cyclic group can be cross linked through free radical curing to make highly resistant insoluble materials. For applications of this type the molecular weight distribution of the polymer is of key importance, as properties such as chemical resistance and rate of cross linking are dependent on the length of the polymer chains. This application describes the analysis of two samples of poly(isobornyl methacrylate) by GPC (gel permeation chromatography).

Conditions

Samples:	Poly(isobornyl methacrylate), 2 mg/mL
Columns:	2 × Agilent PolyPore, 7.5 × 300 mm (part number PL1113-6500)
Inj Vol:	100 µL
Eluent:	Tetrahydrofuran
Flow Rate:	1 mL/min
Detector:	Agilent PL-GPC 50 with DRI

Results and Discussion

Two PolyPore columns from the Agilent PlusPore range, which resolve up to around 2,000,000 g/mol (polystyrene in tetrahydrofuran), were fitted in the oven of a PL-GPC 50. Integrated GPC /SEC System. The poly(isobornyl methacrylate) was fully soluble in tetrahydrofuran and so this solvent was chosen for the analysis. Differential refractive index, standard in the PL-GPC 50, was chosen as the method of detection. Figure 2 shows the overlaid chromatograms for the two materials. In this case it can be seen that the two materials have differing molecular weight distributions and will therefore have considerably different properties in their final application.

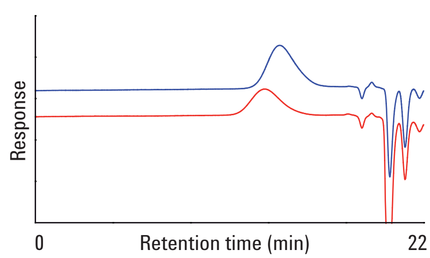

Figure 2. Overlaid chromatograms of two samples of poly(isobornyl methacrylate)

Conclusion

The PL-GPC 50 Integrated GPC/SEC System, when combined with PolyPore columns, is ideal for investigating the molecular weight distributions of methacrylic monomers.

The enhanced PL-GPC 50 is a high resolution, cost effective integrated GPC system designed for operation from ambient to 50 °C. The standard system comprises a precision solvent delivery pump, a sample injection system, a high performance differential refractive index detector and a column oven, with fully integrated software control. For maximum flexibility and applicability, a choice of system enhancements is also available.

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