

# Poly(styrene-*co*-butadiene) GPC with Viscometry

## Application Note

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### Introduction

Styrene/butadiene rubber copolymers are elastomeric materials that show excellent abrasion and aging properties and are used in a wide variety of commercial and industrial applications. For these materials, the molecular weight of the polymer determines many of its final properties and therefore, the end use suitability. The accurate molecular weight distributions of two different samples of polybutadiene were investigated by gel permeation chromatography with viscometry. Light scattering could not be used with these samples as they are copolymers and therefore not of uniform chemistry across the molecular weight distribution. This could lead to errors in the light scattering calculations. However, the Universal Calibration technique employing a viscometer can be used with copolymers to give molecular weight that is independent of the standards used in the column calibration. To investigate the molecular structure of the materials, they were analyzed on an integrated GPC system.



## Instrumentation

The copolymers were analyzed by a Agilent PL-GPC 50 Plus with differential refractive index detector, Agilent PL-BV 400RT viscometer and Agilent PLgel 5  $\mu\text{m}$  MIXED-C columns, which provide high resolution of polymers that have mid-range molecular weights.

Columns: 2 x PLgel 5  $\mu\text{m}$  MIXED-C, 300 x 7.5 mm  
(p/n PL1110-6500)

### Materials and Reagents

Samples: 2 x Poly(styrene-*co*-butadiene)  
Eluent: Tetrahydrofuran

### Conditions

Flow Rate: 1 mL/min  
Temperature: 40 °C

## Results and Discussion

Figure 1 is an example chromatogram of a poly(styrene-*co*-butadiene). Slight differences in the molecular weight distributions of the two samples are clearly shown in Figure 2, but the Mark-Houwink plots in Figure 3 indicate that the materials are structurally very similar.

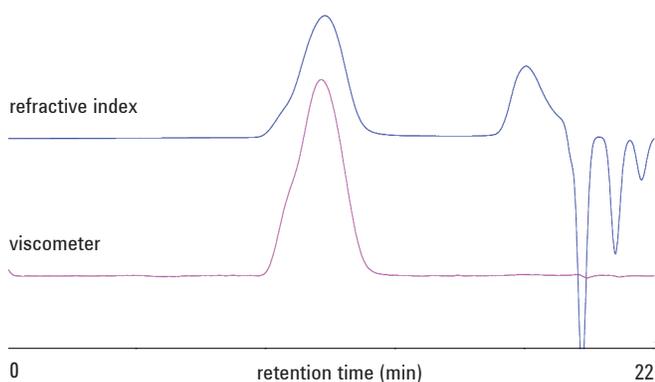


Figure 1. Chromatograms of a poly(styrene-*co*-butadiene)

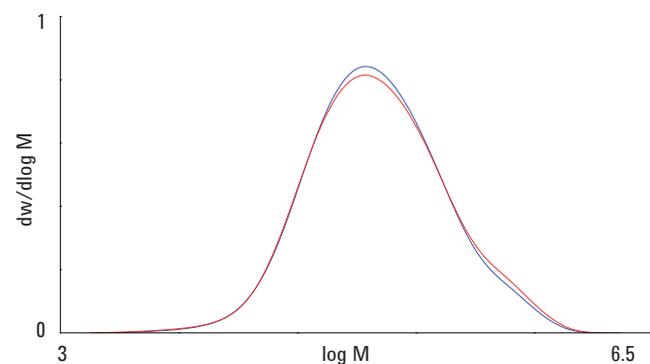


Figure 2. Overlaid molecular weight distributions for two poly(styrene-*co*-butadiene) samples

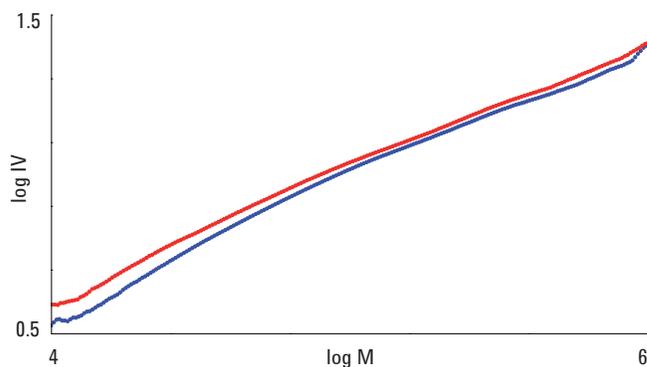


Figure 3. Overlaid Mark-Houwink plots for two poly(styrene-*co*-butadiene) samples

## Conclusion

The PL-GPC 50 Plus is a high resolution, cost effective integrated GPC system designed for operation from ambient to 50 °C. The standard system comprises precision solvent delivery, sample injection, high performance differential refractive index detection and a column oven, with fully integrated software control. When coupled with PLgel columns and a PL-BV 400RT viscometry detector, the PL-GPC 50 Plus provides accurate molecular weight determination for all polymer types based on the Universal Calibration principle, such as poly(styrene-*co*-butadiene) rubber.

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Published in UK, April 30, 2015

5991-5771EN



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