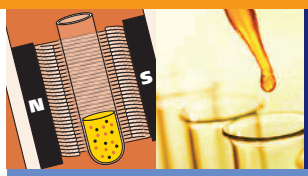
Polybutadiene in Impact Polystyrene



NMR

Benchtop NMR for the Polymer Industry

Polybutadiene (or rubber) is added during polymerisation of styrene to increase the flexibility of polystyrene polymers. It is important to closely monitor the amount of polybutadiene added, so that the flexibility of the polystyrene polymer may be regulated. NMR can provide an effective and rapid method for the regulation of polybutadiene content in Impact Polystyrene.

Method

NMR has a number of advantages over other techniques:

- It can be calibrated to cover a range from 0 to 100%.
- The measurement time is short (typically 32 seconds), allowing for rapid sample throughput.
- The NMR technique is non-destructive, so polystyrene analysed is still usable.
- NMR is insensitive to air voids between polystyrene granules.
- NMR is very stable over the long-term, so calibrations will rarely require adjustment.
- NMR does not require the use of hazardous solvents.
- Both weighing and non-weighing methods are available for this application.

Calibration and Results

12 samples of Impact Polystyrene were selected for the measurement of polybutadiene content. Each sample was weighed into a tared 26mm glass tube before measurement at room temperature in the **MQC**-23.

Figure 1 shows the calibration generated from these samples. The graph illustrates the calibration of the NMR signal against a value of polybutadiene content obtained by a standard technique.

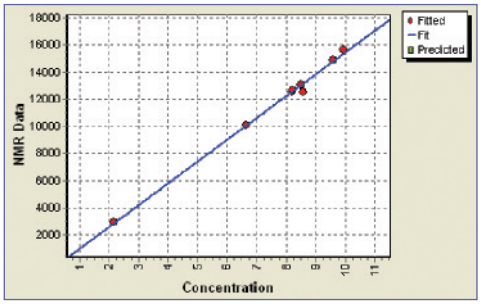


Figure 1: Calibration of NMR data and given polybutadiene content. Green squares indicate outliers. Correlation: r =1, SD = 0.15.

Table 1 shows the repeatability (or precision) of the NMR data is excellent.

Repeat number	Polybutadiene Content (%)
1	6.79
2	6.81
3	6.80
4	6.81
5	6.79
6	6.78
7	6.81
8	6.79
9	6.79
10	6.80
AVERAGE	6.80
SD	0.009

Table 1: Repeatability of NMR measurement.

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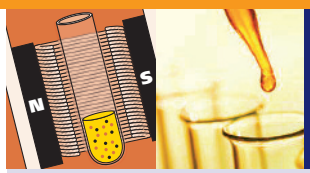

NMR

Recommended Instrument

The **MQC**-23 fitted with a 26mm diameter (14ml sample) probe is a suitable instrument for this application. The Rubber in Impact Polystyrene package consists of:

- **MQC**-23 with a built in computer operating the latest version of Microsoft® Windows® (no separate PC is required).
- Multiquant software including RI Calibration, RI Analysis, and the EasyCal 'Rubber in Polystyrene' application.
- 26mm diameter glass tubes.
- Installation manual.
- 'Rubber in Polystyrene' method sheet.
- In addition to this package you may also require a precision balance.

The instrument offers advantages over others on the market:

- High signal sensitivity.
- Small benchtop footprint.
- Low maintenance.
- Recyclable sample tubes, lowering consumable costs.

Note: Other instruments/packages are available for the analysis of larger or smaller quantities of sample. Please contact Oxford Instruments for details.

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