Molecular Weight Distributions In Polymers

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Polymers are complex materials composed of long chains of atoms. The molecular weight of a polymer chain is the sum of the atomic weights of all the atoms in the chain. The molecular weight distribution (MWD) of a polymer is a measure of the distribution of molecular weights in a polymer sample. MWD is important because it affects the physical and mechanical properties of the polymer.

Molecular Weight of Polymers

Polymers can be either monodisperse or polydisperse. A monodisperse polymer is one in which all the molecules have the same molecular weight. A polydisperse polymer is one in which the molecules have a range of molecular weights. The molecular weight distribution of a polymer is a measure of the distribution of molecular weights in the polymer.

Molecular Weight Averages

There are several types of molecular weight averages: number average, weight average, and osmolality average. The number average molecular weight is the average molecular weight based on the number of monomer units in the polymer chain. The weight average molecular weight is the average molecular weight based on the mass of the polymer. The osmolality average molecular weight is the average molecular weight based on the osmolality of the polymer.

Molecular Weight Distribution

The molecular weight distribution of a polymer is a measure of the distribution of molecular weights in the polymer. It is often represented as a bell curve, with the peak of the curve representing the most common molecular weight. The shape of the molecular weight distribution can affect the physical and mechanical properties of the polymer.

Molecular Weight Distribution and Rheology

The molecular weight distribution of a polymer can affect its rheological properties. Polymers with a narrow molecular weight distribution tend to have better rheological properties than polymers with a broad molecular weight distribution.

Molecular Weight Distribution and Blending

The molecular weight distribution of a polymer can affect its blending properties. A polymer with a broad molecular weight distribution can be blended with a polymer with a narrow molecular weight distribution to improve the blending properties.

Molecular Weight Distribution and Processing

The molecular weight distribution of a polymer can affect its processing properties. Polymers with a broad molecular weight distribution tend to have better processing properties than polymers with a narrow molecular weight distribution.

Molecular Weight Distribution and Performance

The molecular weight distribution of a polymer can affect its performance properties. Polymers with a broad molecular weight distribution tend to have better performance properties than polymers with a narrow molecular weight distribution.

Molecular Weight Distribution and Applications

The molecular weight distribution of a polymer can affect its applications. Polymers with a broad molecular weight distribution tend to have more applications than polymers with a narrow molecular weight distribution.

Molecular Weight Distribution and Synthesis

The molecular weight distribution of a polymer can be controlled during the synthesis process. Synthetic methods such as free radical polymerization and anionic polymerization can be used to control the molecular weight distribution of a polymer.

Molecular Weight Distribution and Analysis

The molecular weight distribution of a polymer can be determined using techniques such as size exclusion chromatography and light scattering.

Molecular Weight Distribution and Modeling

The molecular weight distribution of a polymer can be modeled using computer programs. These programs can be used to predict the physical and mechanical properties of a polymer based on its molecular weight distribution.

Molecular Weight Distribution and Quality Control

The molecular weight distribution of a polymer can be used for quality control purposes. Polymers with a broad molecular weight distribution may not meet certain quality standards.

Molecular Weight Distribution and Environmental Impact

The molecular weight distribution of a polymer can affect its environmental impact. Polymers with a broad molecular weight distribution may have a higher environmental impact than polymers with a narrow molecular weight distribution.

Molecular Weight Distribution and Economics

The molecular weight distribution of a polymer can affect its economics. Polymers with a broad molecular weight distribution may be more expensive to produce than polymers with a narrow molecular weight distribution.

Molecular Weight Distribution and Future Research

The molecular weight distribution of a polymer is an area of active research. New methods for controlling the molecular weight distribution of polymers are being developed, and new applications for polymers with specific molecular weight distributions are being explored.
This paper has described a method to obtain the molecular weight distribution (MWD) of polymeric materials from their rheological data. In Figure 28 the peak (Mp) is at about 40,000. Number average (\(\bar{M}_n\)) and weight average (\(\bar{M}_w\)) molecular masses fall below and above the peak value. Determined