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Selection of Proper Mounting Media for Examining Heterogeneous Copolymers with the Phase Microscope

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Synopsis

A technique for examining heterogeneous copolymers with the phase microscope is described. This method is based on the use of a mounting medium that displays selective solubility toward the constituent materials, thereby masking one or more phases in order to provide suitable phase contrast and isolation of the constituent to be examined.

Introduction

The phase microscope has proven itself to be a most valuable tool in evaluating heterogeneous copolymers, but the use of this relatively new instrument has created a need for new mounting media and methods. Microscopists just starting to work with polymers soon realize that many of the old standard methods based on simply transparentizing the specimen are inadequate. The purpose of this paper is to provide some direction in a choice of mounting media for copolymers by describing a method for mounting and observing impact polystyrene, a rubber–polystyrene copolymer.

Technique

In evaluating a heterogeneous copolymer the major problem is the separation of the constituents of the copolymer and the masking of one or more of the constituents in order to provide suitable phase contrast. The problem of producing a slide of heterogeneous copolymer for examination of the size and character of the constituent materials can be attacked in three ways. The simplest method involves cutting a very smooth, thin section and mounting it in a medium that is completely inert with respect to the material being examined.[1] Mounting impact polystyrene in a medium such as glycerol or water is an illustration. This method does present problems, however, because of imperfect wetting of the section and the slowness and meticulousness required. There is also the danger of not cutting through the largest area of large rubber particles in cutting a thin section, making the rubber particle size determinations statistically inaccurate.[2] Moreover, inert mounting media such as these are only temporary mounts at best and cannot be filed for future use.

Another method of attack on the problem of mounting copolymers involves mounting a dry specimen and employing thermal softening to wet the coverslip with partially melted polymer.[2,3] This method solves the problem of imperfect wetting of the coverslip but does not really allow the microscopist to examine the constituent particles of the copolymer in an isolated condition. In the case of impact polystyrene the rubber particles are too closely packed and are overlaid to such an extent that only an indication of particle size is possible, not an accurate determination of size and distribution.

The method of mounting impact polystyrene copolymer that we describe in this paper is based on the use of a mounting medium that displays selective solubility toward the constituent materials in the rubber–polystyrene copolymer. This technique was alluded to by Claver.[4] In addition to selective solubility, the mounting medium should have a high viscosity and the ability to cure or harden into a permanent mount. A 20% solution of polystyrene in styrene monomer fulfills all of these requisites.

The method of mounting involves cutting a thin section of impact polystyrene and placing it on a slide. A drop of polystyrene–styrene mounting medium is placed on the section and a coverslip placed on top. The coverslip is allowed to settle for about 2 min. and is subsequently warmed at 150°F. for 1 min., to allow the mounting medium to form a thin layer. During the mounting process the polystyrene–styrene mounting medium frees the rubber particles from the polystyrene matrix surrounding them while diluting the original section and allowing the rubber particles to spread into a thin layer. While the rubber particles are spreading into a thin layer, the smaller particles are prevented from flowing to the edges of the mount by the high viscosity of the mounting medium. A proper statistical spread is thus ensured. The rubber particles are now spread out for examination in a layer only as thick as the largest particle present in the section. Rubber particle size, shape, and distribution can now be easily evaluated. Slides prepared in this manner are permanent preparations and can be filed for future use.

We have extended this technique to other heterogeneous copolymer systems with considerable success, and we believe that it can be used profitably in many polymer research programs.

References

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3. G. C. Claver and E. H. Merz, *Offic. Digest, J. Paint Technol. and Eng.*, 858 Oct. (1956).

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Résumé

Une technique pour examiner les copolymères hétérogènes en utilisant le microscope de phase est décrite. Cette méthode est basée sur l'utilisation d'un milieu qui permet une solubilité sélective à l'égard des constituants masquant ainsi une ou plusieurs phases; de cette façon on fait apparaître un contraste de phase permettant l'isolement du constituant qu'on désire examiner.

Zusammenfassung

Ein Verfahren zur Untersuchung heterogener Copolymerer mit dem Phasenmikroskop wird beschrieben. Es beruht auf der Verwendung eines Einbettungsmediums mit selektiver Löslichkeit für die Komponenten. Dadurch werden eine oder mehrere Phasen maskiert und ein geeigneter Phasenkontrast sowie eine Isolierung der zu untersuchenden Komponente bewirkt.

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