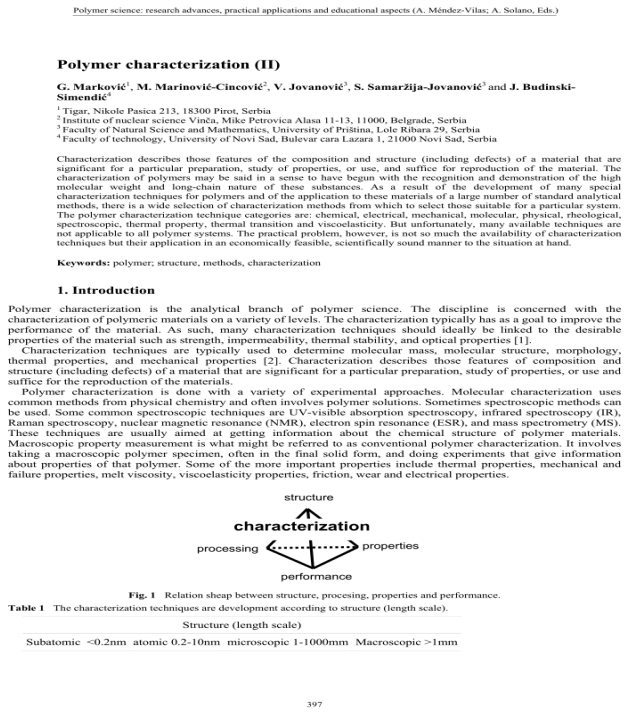
Thermal Analysis of Polymers (Advances in Polymer Science)



Polymer science: research advances, practical applications and educational aspects (A. Méndez-Vilas; A. Solano, Eds.)

Polymer characterization (II)

G. Marković[1], **M. Marinović-Cincović**[2], **V. Jovanović**[3], **S. Samaržija-Jovanović**[3] and **J. Budinski-Simendić**[4]

[1] Tigar, Nikole Pasica 213, 18300 Pirot, Serbia
[2] Institute of nuclear science Vinča, Mike Petrovica Alasa 11-13, 11000, Belgrade, Serbia
[3] Faculty of Natural Science and Mathematics, University of Priština, Lole Ribara 29, Serbia
[4] Faculty of technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia

Characterization describes those features of the composition and structure (including defects) of a material that are significant for a particular preparation, study of properties, or use, and suffice for reproduction of the material. The characterization of polymers may be said in a sense to have begun with the recognition and demonstration of the high molecular weight and long-chain nature of these substances. As a result of the development of many special characterization techniques for polymers and of the application to these materials of a large number of standard analytical methods, there is a wide selection of characterization methods from which to select those suitable for a particular system. The polymer characterization technique categories are: chemical, electrical, mechanical, molecular, physical, rheological, spectroscopic, thermal property, thermal transition and viscoelasticity. But unfortunately, many available techniques are not applicable to all polymer systems. The practical problem, however, is not so much the availability of characterization techniques but their application in an economically feasible, scientifically sound manner to the situation at hand.

Keywords: polymer; structure, methods, characterization

1. Introduction

Polymer characterization is the analytical branch of polymer science. The discipline is concerned with the characterization of polymeric materials on a variety of levels. The characterization typically has as a goal to improve the performance of the material. As such, many characterization techniques should ideally be linked to the desirable properties of the material such as strength, impermeability, thermal stability, and optical properties [1].

Characterization techniques are typically used to determine molecular mass, molecular structure, morphology, thermal properties, and mechanical properties [2]. Characterization describes those features of composition and structure (including defects) of a material that are significant for a particular preparation, study of properties, or use and suffice for the reproduction of the materials.

Polymer characterization is done with a variety of experimental approaches. Molecular characterization uses common methods from physical chemistry and often involves polymer solutions. Sometimes spectroscopic methods can be used. Some common spectroscopic techniques are UV-visible absorption spectroscopy, infrared spectroscopy (IR), Raman spectroscopy, nuclear magnetic resonance (NMR), electron spin resonance (ESR), and mass spectrometry (MS). These techniques are usually aimed at getting information about the chemical structure of polymer materials. Macroscopic property measurement is what might be referred to as conventional polymer characterization. It involves taking a macroscopic polymer specimen, often in the final solid form, and doing experiments that give information about properties of that polymer. Some of the more important properties include thermal properties, mechanical and failure properties, melt viscosity, viscoelasticity properties, friction, wear and electrical properties.

Fig. 1 Relation sheap between structure, procesing, properties and performance.

Table 1 The characterization techniques are development according to structure (length scale).

Structure (length scale)				
Subatomic	<0.2nm	atomic 0.2-10nm	microscopic 1-1000mm	Macroscopic >1mm

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