Study of the Relaxation Phenomenon of Poly(vinyl chloride-co-vinylacetate-co-2-hydroxyprop acrylate)/Poly(methyl methacrylate) Blends Using TSDC-TS Technique: Dipole-dipole Interaction Approach

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Source: JOURNAL OF THE KOREAN PHYSICAL SOCIETY Volume: 59 Issue: 1 Pages: 98-104 DOI: 10.3938/jkps.59.98 Published: JUL 2011

Abstract

The thermally stimulated discharge current (TSDC) technique was used to study the dipolar relaxation mechanism present in Poly (vinyl chloride-co-vinylacetate-co-2-hydroxypropyl acrylate) PVVII, Poly(methyl methacrylate) PMMA and their blends. TSDC global spectra of PVVH/PMMA polyblends exhibited two relaxation processes, indicating that the two polymers were not completely compatible with each other. Thermal sampling technique was used to investigate the breadth of the glass transition temperature covering the a-relaxation in each polymer. Each global spectrum was resolved into its elementary processes and was characterized by using a single relaxation time and an activation energy. These characteristics can be explained in terms of cooperative motions (dipole-dipole interactions) corresponding to long-range conformational changes, characteristic of a-relaxation. The TSDC theory was modified using dipole-dipole interaction effects. The a-relaxation was analyzed in terms of the Arrhenius relaxation times by using an iterative technique. Linearity was found to exist between the activation energy and the logarithm of the pre-exponential factor of the a-relaxation, confirming the validity of the compensation laws.

Accession Number: WOS:000292860000019

Document Type: Article

Language: English

Author Keywords: TSDC; Glass transition; Molecular relaxation; Relaxation time; Activation energy; Compensation

KeyWords Plus: STIMULATED DEPOLARIZATION CURRENT; ALPHA-RELAXATION; DISTRIBUTED RELAXATIONS; POLYMERS; ELECTROLUMINESCENCE; REORIENTATION

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Publisher: KOREAN PHYSICAL SOC, 635-4, YUKSAM-DONG, KANGNAM-KU, SEOUL 135-703, SOUTH KOREA

Web of Science Categories: Physics, Multidisciplinary

Research Areas: Physics

IDS Number: 793YK

ISSN: 0374-4884

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Author(s): Ahmed, M. T.
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Dielectric and Electric Modulus of Poly(3-hydroxybutyrate) Semi-crystalline Polymer

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Source: INTERNATIONAL JOURNAL OF POLYMERIC MATERIALS Volume: 57 Issue: 12 Pages: 1075-1082 DOI: 10.1080/00914030802257859 Published: 2008

Abstract

We present results of dielectric investigation of poly(3-hydroxybutyrate) (PHB) semi-crystalline polymer. The data obtained are treated in the view of electric modulus formalisms in order to correlate the effects of the conductivity on the net dielectric relaxation phenomena. The results reveal that the conductive relaxation processes contribution in the low frequency region is much larger than in the high frequency region. At high temperatures (above the glass transition temperature), the electrical properties are strongly influenced by the space charge. Finally the plot of the complex electric modulus for a given temperature in Argand's plane shows that the conductive processes are reflected by an arc at low frequency which agrees with the model of Coelho.

Accession Number: WOS:000260779700002

Document Type: Article

Language: English

Author Keywords: conductive processes; dielectric relaxation; electric modulus; PHB

KeyWords Plus: VITREOUS IONIC CONDUCTORS; RELAXATION; GLASSES

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Publisher: TAYLOR & FRANCIS AS, KARL JOHANS GATE 5, NO-0154 OSLO, NORWAY

Web of Science Categories: Polymer Science

Research Areas: Polymer Science

IDS Number: 370RF

ISSN: 0091-4037

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Source: JOURNAL OF THE KOREAN PHYSICAL SOCIETY Volume: 59 Issue: 1 Pages: 98-104 DOI: 10.3938/jkps.59.98 Published: JUL 2011

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Author(s): Fahmy, T; Ahmed, MT Source: POLYMER TESTING Volume: 20 Issue: 5 Pages: 477-484 DOI: 10.1016/S0142-9418(00)00060-X Published: 2001

Dielectric Relaxation Spectroscopy of a Poly (Acrylonitrile-Butadiene-Styrene)/Styrene-Acrylonitrile Polymer Blend

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Source: JOURNAL OF THE KOREAN PHYSICAL SOCIETY Volume: 58 Issue: 6 Pages: 1654-1659 DOI: 10.3938/jkps.58.1654 Published: JUN 2011

Abstract

Dielectric relaxation spectroscopy has been investigated for pure poly (acrylonitrile-butadiene-styrene) (ABS), pure styrene-acrylonitrile (SAN) and a ABS/SAN polymer blend in the frequency range from 100 Hz to 100 kHz at different temperatures. We observed that all samples were characterized by a high dielectric constant (epsilon') at low frequency and high temperature. In addition, the dielectric loss (tan delta) showed a frequency dependent relaxational peak for all samples. Moreover, the temperature dependence of the AC conductivity was investigated for all samples, and the values of the activation energy were estimated .

Author Keywords: Dielectric constant; Dielectric loss; AC conductivity; Polymer blends; Relaxation

KeyWords Plus: CONCENTRATION FLUCTUATIONS; GLASS-TRANSITION; CONDUCTIVITY; NAPHTHALATE); CONSTANT; DYNAMICS

Reprint Address: Fahmy, T (reprint author) Alkharj Univ, Fac Sci & Human, Dept Phys, Alkharj 83, Saudi Arabia .

Publisher: KOREAN PHYSICAL SOC, 635-4, YUKSAM-DONG, KANGNAM-KU, SEOUL 135-703, SOUTH KOREA

Web of Science Categories: Physics, Multidisciplinary

Research Areas: Physics

IDS Number: 778BI

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Relaxational Study of Poly(ethyl methacrylate) by Using the Thermally Stimulated Depolarization Current-thermal Sampling Spectroscopy: Modified Dipole-dipole Interaction Theory

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Source: JOURNAL OF THE KOREAN PHYSICAL SOCIETY Volume: 57 Issue: 2 Pages: 272-281 DOI: 10.3938/jkps.57.272 Published: AUG 2010

Abstract

The temperature and the electric-field dependences of the dielectric relaxation have been investigated in amorphous poly(ethyl methacrylate) (PEMA) thin films by using the thermally stimulated discharge current (TSDC) and the thermal sampling (TS) techniques and AC dielectric measurements. All measurements were performed on cast thin films with thicknesses of 50 - 60 mu m over a temperature range covering the glass transition region (alpha-relaxation). The nature of relaxation mechanisms in amorphous PEMA is discussed on the basis of the TSDC and dielectric results. Comparative studies of the dielectric properties obtained by using the TSDC indicated a strong resemblance between the two techniques. PEMA films are characterized by two TSDC relaxation peaks, revealing the presence of two major relaxation processes and termed as the alpha-peak, around 341 K. and the rho-peak ranging from 385 K to the 403 K, associated with dipolar relaxation and space charge relaxation processes, respectively. The thermal sampling technique (TS) was used to resolve the complex TSDC behavior of the films to obtain the elementary peaks characterized by the Debye relaxation time. The dependence of the peak temperature T(m) on the polarizing temperature T(p) indicated a continuous distribution of relaxation times. The activation parameters characterizing the TS peaks, such as the activation energy (E), the pre-exponential factor (tau(0)) and the dipole-dipole interaction strength parameter (d(i)), have been estimated by using a modified approach of the TSDC theory with the dipole-dipole interaction effect and two relaxation models, the Arrhenius (DDIAR) and the Vogel-Tamman-Fulcher (DDIVTF) relaxation models. Good results were obtained in comparison with other methods such as the initial rise method. A linear relationship between the activation enthalpy (Delta H) and activation entropy (Delta S) of the alpha-relaxations was obtained, confirming the validity of the compensation law .

Accession Number: WOS:000281022800012

Document Type: Article

Language: English

Author Keywords: Relaxation processes; Poly(ethyl methacrylate); Thermally stimulated discharge current (TSDC); Thermal sampling (TS); Dipolar relaxation; Entropy; Enthalpy; Compensation

KeyWords Plus: SPACE-CHARGE; DISTRIBUTED RELAXATIONS; DIELECTRIC-RELAXATION; POLYMER BLENDS; TERPOLYMER; TRANSITION; VISCOSITY; DISCHARGE; TSDC; TSC

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Publisher: KOREAN PHYSICAL SOC, 635-4, YUKSAM-DONG, KANGNAM-KU, SEOUL 135-703, SOUTH KOREA

Web of Science Categories: Physics, Multidisciplinary

Research Areas: Physics

IDS Number: 640BS

ISSN: 0374-4884

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Author(s): Ahmed, MT; Fahmy, T
Source: POLYMER TESTING Volume: 18 Issue: 8 Pages: 589-599 DOI: 10.1016/S0142-9418(98)00057-9 Abstract Number: A1999-21-6140K-004 Published: 1999

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Author(s): Migahed, MD; Ahmed, MT
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Dielectric and Electric Modulus of Poly(3-hydroxybutyrate) Semi-crystalline Polymer

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Source: INTERNATIONAL JOURNAL OF POLYMERIC MATERIALS Volume: 57 Issue: 12 Pages: 1075-1082 DOI: 10.1080/00914030802257859 Published: 2008

Abstract

We present results of dielectric investigation of poly(3-hydroxybutyrate) (PHB) semi-crystalline polymer. The data obtained are treated in the view of electric modulus formalisms in order to correlate the effects of the conductivity on the net dielectric relaxation phenomena. The results reveal that the conductive relaxation processes contribution in the low frequency region is much larger than in the high frequency region. At high temperatures (above the glass transition temperature), the electrical properties are strongly influenced by the space charge. Finally the plot of the complex electric modulus for a given temperature in Argand's plane shows that the conductive processes are reflected by an arc at low frequency which agrees with the model of Coelho .

Accession Number: WOS:000260779700002

Document Type: Article

Language: English

Author Keywords: conductive processes; dielectric relaxation; electric modulus; PHB

KeyWords Plus: VITREOUS IONIC CONDUCTORS; RELAXATION; GLASSES

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Organization-Enhanced Name(s (

King Saud University

Publisher: TAYLOR & FRANCIS AS, KARL JOHANS GATE 5, NO-0154 OSLO, NORWAY

Web of Science Categories: Polymer Science

Research Areas: Polymer Science

IDS Number: 370RF

ISSN: 0091-4037

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Conference: 2nd International Discussion Meeting on Relaxations in Complex Systems Location: ALICANTE, SPAINDate: JUN 28-JUL 08, 1993
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Author(s): MOYNIHAN, CT; BOESCH, LP; LABERGE, NL
Source: PHYSICS AND CHEMISTRY OF GLASSES Volume: 14 Issue: 6 Pages: 122-125 Abstract Number: A1974-063942 Published: 1973

Computation of TSDC peak parameters in amorphous polymers using Vogel-Tammann-Fulcher relaxation model

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Source: JOURNAL OF MACROMOLECULAR SCIENCE-PHYSICS Volume: B44 Issue: 1 Pages: 43-53 DOI: 10.1081/MB-200044579 Published: JAN-FEB 2005

Abstract: We have modified the thermally stimulated depolarization current (TSDC) theory so that it contains the relaxation obeying the Vogel-Tammann-Fulcher relaxation model. Thermal sampling (TS) technique was used to decompose the complex TSDC spectrum to a number of elementrary peaks. Numerical method is applied for the analysis of TS spectra for the amorphous polar poly(vinyl chloride-co-vinyl acetate-co-2-hydroxypropyl acrylate) (PHHV); poly(methyl methacrylate) (PMMA), and poly(vinyl chloride) (PVC). The characteristic alpha-relaxation peak parameters, namely the pre-exponential factor (tau(0)) and its related Vogel-Tammann-Fulcher (VTF) energy (E-VTF), for each thermal windowing (TW) experiment were determined. The almost temperature independence of the peak parameters suggests that this behavior is a result of segmental dipole relaxation, and consequently, there is no distribution in both peak parameters .

Author Keywords: VTF relaxation model; TS technique; analytical method; amorphous polymers; alpha-relaxation; TSDC

KeyWords Plus: STIMULATED DEPOLARIZATION CURRENT; GLASS-FORMING LIQUIDS; TEMPERATURE-DEPENDENCE; ALPHA-RELAXATION; CURRENTS; BLENDS; MECHANISMS; CHLORIDE); BUTADIENE; MOTIONS

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Publisher: MARCEL DEKKER INC, 270 MADISON AVE, NEW YORK, NY 10016 USA

Web of Science Categories: Polymer Science

Research Areas: Polymer Science

IDS Number: 899LC

ISSN: 0022-2348

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Author(s): MIGAHED, MD; AHMED, MT; KOTP, AE; et al .
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Author(s): Migahed, MD; Ahmed, MT; Kotp, AE
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Author(s): MIGAHED, MD; ISHRA, M; FAHMY, T
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