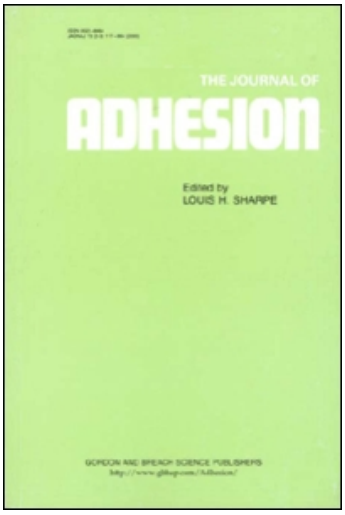

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Vol. 27 No. 7 1991

Contents

Effect of the Addition of Accelerators on the Mechanical Properties of Amine-cured Epoxy Resin.

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Abstract

Effect of the addition of accelerators on mechanical and thermal properties of amine-cured epoxy resin was investigated. In addition, the changes in the concentration of functional groups, such as primary and secondary amines, was followed along the progress of curing.

The cured epoxy system accelerated with imidazoles has lower crosslinking density, lower glass transition temperature, and higher fracture toughness than those of non-accelerated and salicylic acid-accelerated sytems. These results show that the mobility of network chains in former system is greater than that of other two systems.

Moreover, it was observed in the imidazole-accelerated system that the homopolymerization reaction of epoxy groups is accelerated and the reaction with secondary amine is considerably suppressed by the addition of imidazole. Thus, we assumed that the peculiar thermal and mechanical properties of this

system is due to the increase in the heterogeneity of network structure with increasing the ratio of the epoxy homopolymerization.

(Received: February 28, 1991)

Synthesis and Ionic Conductivity of Adhesives Composed of Complexes from Segmented Polyether-urethane and Lithium Perchlorate.

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Abstract

Ion-conducting adhesives were synthesized from $LiClO_4$ and segmented polyether-urethanes consisting of various PAOs (PPO, EO/PO copolymer, M-PEG) which are liquid at room temperature. The effects of molecular structure (segment composition, size of network, and structure of branched chain), salt concentration, and temperature on the conductivity were examined for these polyurethane adhesives.

The ionic conductivity (σ:S/cm) was highest when we used the EO/PO random copolymer ($\overline{M_w}$; 2,000. EO/PO = 50/50 mole ratio) as the polyol component, glycolglycerin ether ($\overline{M_w}$; 2,000, EO/PO = 50/50 mole ratio) as the isocyanate component, and M-PEG ($\overline{M_w}$; 400) as the branched chain, the M-PEG/P-OH and the OH/NCO ratio being 3/2 mole ratio and 1.05, respectively. At the salt concentration [Li]/[—O—] was kept from 1/100 to 10/100, σ was 10^{-3}–10^{-4} (100°C). 10^{-4}–10^{-5} (room temperature), and 10^{-6} (S/cm) (0°C).

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Contents

Bubble Restraining Effect of a Paper Cup Laminated with Polyethylene Blended with a New Modified Silicone Compound for Carbonated Drinks

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Abstract

We have previously reported that a paper cup laminated with a polyethylene blended with a new modified silicone compound (NR-B) showed bubble restraining effect when carbonated drinks were poured into the cup.

This bubble restraining phenomenon was related to the improvement of surface properties by NR-B, that is, the contact angle θ for water was large and the difference $\Delta\theta$ between the advancing contact angle (θ_a) and the receding contact angle (θ_r) was small.

The relation between the surface properties including θ and $\Delta\theta$ and the heights of bubbles when carbonated drinks were poured into the cup for various substances was investigated.

The results were as follows:

1) Bubbling phenomena when carbonated drinks were poured into the cup was related to the value of $\Delta\theta$.

If $\theta>90°$ and roughness of inner surface was equal, apparently the smaller $\Delta\theta$ was, the lower the height of bubble ℓ was.

2) The relation between $\Delta\theta$ and ℓ was different whether θ was larger or smaller than 90°, therefore it was necessary to distinguish them.

$\Delta\theta$ was also influenced by roughness of the surface. That is, the greater the roughness was, the larger $\Delta\theta$ was, when $\theta>90°$.

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Characteristics of Ion-conducting Adhesives Composed of Complexes from Segmented Polyether-urethane and Lithium Perchlorate.

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Abstract

The solvation of poly (alkylene oxide) (PAO; PPO, EO/PO copolymer, M-PEG) and salt in ion-conducting adhesives (ICA) from segmented polyether-urethane and $LiClO_4$ occurred selectively at the EO chain, and the state of aggregation of the segments governed the dependence of the ionic conductivity on temperature and salt concentration. The solvation of salt and PAO was likely to be produced macroscopically homogenously when the block copolymer-block copolymer (B-B) combination was used as the polyol and isocyanate component segments and microscopically homogenously when the random copolymer-random copolymer (R-R) combination was used.

The excellent adhesion of ICA made them suitable for use as medical adhesives at the [Li]/[—O—] = 3/100–5/100. The ionic conductivity at body surface temperature was similar to that of the skin. ICAs were non-toxic on human skin. These results suggest that they could be applied in the field of medical engineering such as bioelectrodes for reception of bioelectricity from the human body and electric therapy.

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Contents

Structure and Properties of Epoxy Resins Prepared from 6-Nuclei Novolacs

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Abstract

The relation between the structure and properties of epoxy resins prepared from 6-nuclei novolacs was studied. First, three kinds of 6-nuclei novolacs were prepared by the reaction of bis [4-hydroxy-3, 5-bis (hydroxymethyl) phenyl] methane with phenol, *o* -cresol or 2,6-xylenol in the presence of catalytic amount of HCl. Then, these novolacs were glycidyletherified by epichlorohydrin. Finally, these epoxy resins were cured with 4,4′-diaminodiphenylmethane as a hardener. From the measurement of temperature dispersion in the viscoelastic properties of cured epoxy resins, glass transition temperature (Tg) and storage modulus (E′) at a glassy or a rubbery region were obtained. Then, the coefficient of linear expansion was obtained by TMA measurement. From these characteristic properties, it was found that the epoxy resins (from 6-nuclei novolacs gave more heat-resistant cured resins compared with the ordinary *o*-cresol novolac type epoxy resin.

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Fracture Behavior of Thermoplastic Modified Epoxy Resins

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Abstract

This work has shown that the addition of PEI can significantly increase the toughness of highly cross-linked epoxy resins, whilst retaining a high Tg and a high modulus. These combined properties indicate the potential of PEI modified epoxy resins for use as matrices for advanced composites materials. In terms of G_{IC}, addition of 20% wt PEI raised the toughness by a factor of eight. Evidence from SEM fracture surfaces suggest that the toughening mechanism operating in bulk PEI modified epoxy resin is ductile drawing of the PEI. Carbon fiber composites based upon 30% wt PEI modified epoxy resin matrices, show considerable improvement in toughness at low and high strain rates when compared with CERP possessing unmodified or 20% wt PEI content epoxy resins.

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