

Gyunggoo Cho, Sung-Seen Choi, and Ik-Sik Kim
Effect of Heated *p-t*-Octylphenol Formaldehyde Resole on the Vulcanization of Natural Rubber
Korea Polymer Journal, 5(3), 133 (1997)

Thermal reactions of *p-t*-octylphenol formaldehyde resole, SP-1045, at 160 °C were investigated using infrared(IR) spectroscopy and gel permeation chromatography(GPC). The formation of *o*-methylene quinone intermediate and the dissociation of dimethylene ether-linkage in SP-1045 were found. Characteristic peak intensities in IR absorbance spectra of the *o*-methylene quinone intermediate increased while those of dimethylene ether-linkage in SP-1045 decreased linearly as heating time of SP-1045 was increased. Notable change of molecular weight distribution of the resole was not observed within 1.5 hours in GPC. Trimer content increased continuously with the increase of heating time while dimer content began to increase after heating SP-1045 for 6 hours. The vulcanizing behavior of natural rubber(NR) compounds containing heated SP-1045 was studied using a rheometer. It was observed that the scorch time of the NR compounds were not affected by the thermal reactions of SP-1045. However, torque increase(Δ torque) in rheographs of the NR compounds decreased as the heating time of SP-1045 was increased.

Junhan Cho
A Study on the Thermodynamic Properties of Two Isomeric Poly(butyl methacrylates)
Korea Polymer Journal, 5(3), 139 (1997)

The recently formulated corresponding states equation of state by Sanchez and Cho is used to compare the bulk thermodynamic data of isomeric poly(*n*-butyl methacrylate) (PnBMA) and poly(*i*-butyl methacrylate) (PiBMA). This new equation of state is based on the temperature-pressure(T-P) superposition principle of compression of polymers. The bulk data of PiBMA is measured by using the high pressure dilatometer. The T-P superposition is shown to be supported by the volumetric data of PiBMA. The new corresponding states equation of state distinguishes polymers by characteristic mass density ρ^* , temperature T^* , and pressure P^* . These parameters are obtained for the two isomers by fitting the bulk

data to the equation of state. The three characteristic parameters ρ^* , T^* , and P^* successfully describe the structural differences between the two isomeric polymethacrylates having butyl side groups with different excluded volumes. The ρ^* shows that the packing efficiency of PiBMA is higher than that of PnBMA. PiBMA has a greater fractional free volume at the glass transition temperature(T_g), which is identical to T_g/T^* , than PnBMA does. However, the both polymers have the identical cohesive energies P^*v^* or P^*/ρ^* .

S. B. Kil, O Ok Park, K. H. Yoon, and C. I. Hwang
Effects of Chemical Reaction on the Properties of Reactive Blends between Poly(butylene terephthalate) and Liquid Crystalline Polymer
Korea Polymer Journal, 5(3), 145 (1997)

In order to understand the effects of chemical reaction on the properties of the reactive blend prepared by the melt-phase reaction of poly(butylene terephthalate) and liquid crystalline polymer(LCP), the crystallization behavior, complex viscosity and the molecular weight of the blends were studied. Because of the hindered crystallization due to the presence of the melt phase LCP, the crystallization temperature of the PBT/LCP blend decreased with increasing LCP content. The transesterification reaction had no effect on the crystallization behavior and complex viscosity, except for A2 sample(PBT90/LCP10 reactive blend at 260(C for 1hour) and B2 sample(PBT70/LCP30 reactive blend at 260(C for 1hour). The reactive blends showed the fast crystallization due to annealing and increased the molecular weight due to the end-to-end reaction.

Haksoo Han and Moonhor Ree
High Temperature Polyimide Thin Films: The Effect of Photosensitive(DMAEM) Precursor and Different Backbone Structures on Water Sorption
Korea Polymer Journal, 5(3), 152 (1997)

Three different polyimide films, BPDA-PDA, PMDA-ODA, and BTDA-ODA, were prepared from amic acid and photosensitive(DMAEM) precursors. The effect of backbone structures and precursors on

the water sorption and the morphological structure in polyimide thin films was investigated. Gravimetric technique was employed to study the water sorption kinetics and wide angle X-ray diffraction(WAXD) technique for the morphological structure investigation of fully cured polyimide thin films. PMDA-ODA, BPDA-PDA and BTDA-ODA polyimide films prepared from amic acid precursor exhibited water diffusivities of $10.5 \times 10^{-10} \text{ cm}^2 \text{ sec}^{-1}$, $1.4 \times 10^{-10} \text{ cm}^2 \text{ sec}^{-1}$, and $10 \times 10^{-10} \text{ cm}^2 \text{ sec}^{-1}$, respectively. For the linear BPDA-PDA polyimide, photosensitive (DMAEM) precursor disrupted the packing order in the microstructure. The disordered structure of polyimide thin film affected significantly the water sorption kinetics. The diffusivity of water in BPDA-PDA polyimide thin film prepared from photosensitive precursor was increased to $5.0 \times 10^{-10} \text{ cm}^2 \text{ sec}^{-1}$. However, for the hinged PMDA-ODA and BTDA-ODA polyimide thin films prepared from photosensitive precursor no significant changes was observed in the morphological structure and water sorption kinetics.

Minjin Ko and Myungwhan Kim
Effect of Surface Modification of Fillers on the Properties of IC Encapsulating Compounds
Korea Polymer Journal, 5(3), 160 (1997)

The effect of the surface modification of silica fillers on the properties of IC encapsulating compounds was studied. It was found that the effect on the mechanical strength was clearly appeared at high temperature and after moisture uptake. The mechanical strength increased by increasing the content of coupling agents. However excess amount of coupling agents degraded the strength of encapsulating compounds. The surface treatment of fillers with coupling agents could either increase or decrease the flowability of encapsulating compound, depending on the content and species of agents used. In case of the epoxy silane, the spiral flow was increased by adding the large amount of the agent, while the amino silane degraded the flowability. The surface treatment of fillers also showed a great effect on the workability of the encapsulating compound including flash/bleed and pot life. Excess usage of the agents could increase the flash/bleed length and accelerate the curing reaction even at room temperature, resulting in the deterioration of compound's pot life. C-SAM results showed the effect of coupling agents on the adhesion of molding compounds to leadframe metal substrate. Amino silane had a better adhesion strength than

epoxy silane.

Yong Soo Kang, Bumsuk Jung, Hyun Chae Park, Jongok Won, Un Young Kim, Jongeon Kim, and Hee-Woo Rhee

Formation of Integrally Skinned Asymmetric Membranes without Skin Defects for Gas Separation
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An integrally skinned asymmetric polysulfone membrane was prepared by the phase inversion method. Its skin was defect-free so that an additional coating process was not necessary to caulk the skin defects for gas separation. Its separation factor of oxygen over nitrogen reached 5. Such a high separation factor could arise from the gelation of the interfacial layer between the dope solution and the gelation medium due to its increased polymer concentration before the liquid-liquid demixing. Experimentally, the polymer concentration at interface was controlled by the flux ratio of solvent to nonsolvent, R , which was, in turn, manipulated by introducing a cosolvent, ethyl acetate. Because the cosolvent has lower surface tension than the main solvent, N-methyl pyrrolidinone, the cosolvent-rich layer might be formed at the interface, which seemed to primarily control the flux ratio of solvent to nonsolvent. It was verified that an integrally skinned membrane without skin defects could be formed when the polymer concentration at interface was high before the onset of liquid-liquid demixing, and that the flux ratio played a crucial role in determining the membrane morphology.

S. G. Lyu, J. G. Ryu, G. S. Sur, and J. H. Ahn
A Study on Physical Properties of Precipitated CaCO₃/LDPE Composites
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The precipitated calcium carbonate was synthesized in an emulsion of reaction mixture. The reaction temperature and type of solvent were found to have a significant effect on the shape and polymorphs of calcium carbonate. The surface of synthesized calcium carbonate, which was prepared in this study, was found to be hydrophobic. Thermal and mechanical properties of composites, containing the calcium carbonate in a low density polyethylene (LDPE) matrix, were also studied by varying the amount of the calcium carbonate. Due to the hydrophobic nature of the modified calcium carbon-

ate, the interfacial adhesion of the composite was found to be excellent. Results indicated that the crystallization temperature and crystallinity of the composites increased in proportion to the volume fraction of the hydrophobic calcium carbonate.

Harvest L. Collier and Il Young Cho
Syntheses and Characterization of Polycarbonates Based on 1,1'-Dihydroxyethyl-2,2'-Biimidazole
Korea Polymer Journal, 5(3), 179 (1997)

Polycarbonates containing 2,2'-biimidazole were synthesized by the transesterification reaction of 1,1'-dihydroxyethyl-2,2'-biimidazole(HEB) and diphenyl carbonate(DPC). The experimental conditions for polymerization were also investigated in terms of the catalyst types, such as NaOMe and TiCl₄. The maximum number average molecular weight($M_n=24,800$) of polymer was attained in case of equimolar ratio of HEB to DPC with 0.2% TiCl₄ as a catalyst and DMSO as solvent. When MaOMe was used as a catalyst, there was no significant difference in the molecular weight(13,000) compared with no catalyst case (10,900). FTIR and NMR spectral characterizations showed that the isolated polymer exhibited a linear structure with regular incorporation of 2,2'-biimidazole units. The polymer decomposition was less than 9% at 200 °C in air.

Harvest L. Collier and Il Young Cho
Syntheses and Characterization of Transition Metal Complexes of 2,2'-Biimidazole Containing Polycarbonates
Korea Polymer Journal, 5(3), 185 (1997)

Polycarbonates containing 2,2'-biimidazole have been used to synthesize and characterize the new non-pendent, non-bridging polycarbonate supported transition metal complexes. This polymer-bound metal complexes were prepared from the reaction of metal ion solutions with prepared parent polycarbonates and from the solution transesterification reaction between transition metal complexes of 1,1'-dihydroxyethyl-2,2'-biimidazole [HEB-M(II)] and diphenyl carbonate(DPC). Compared with the uncomplexed polycarbonates, isolated polymer complexes of Zn(II) and Cu(II) formed by HEB-M(II)/DPC transesterification were found to have the lower molecular weight and thermal decomposition weight loss less than 3% at 200°C in air. Solution metal complexed parent polycarbonates showed the influ-

ence of the molecular steric factors that enhances the degree of polymerization and extent of metal binding.

Insok Cho, Jin Ho Kim, and Sung Soo Kim
Thermally-Induced Phase Separation Mechanism Study for the Preparation of Semicrystalline Polymeric Membranes
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Thermally-induced phase separation mechanisms were investigated for the structure control of the semicrystalline polymeric membrane. Isotactic polypropylene showed the better resistance to the organic solvents than the other polymers for membrane materials tested in this work. Depending on the location in the phase diagram each sample had its own phase separation mechanism to result in the unique structure. The sample structure depended on the competitive liquid-liquid phase separation and polymer crystallization. The initial polymer composition, quench depth, cooling rate and the holding time in the liquid-liquid phase separation region had great influences on the structure information. Interpretations of the structure formation based on the mechanism study were performed.

Platelet Adhesion onto PEG-grafted Poly(L-glutamate) Surfaces
Jin Ho Lee, Young Min Ju, Su Kyoung Kim, Sang Tak Lee, and Young Wook Park
Korea Polymer Journal, 5(3), 199 (1997)

Poly(L-glutamate) grafted with polyethylene glycol (PLG-*g*-PEG) was synthesized by substituting benzyl groups in poly(γ -benzyl L-glutamate) (PBLG) with PEG monomethyl ether(MPEG) having different repeat unit, 1, 2, 3, and 6 through transesterification reaction. The PBLG and PLG-*g*-PEGs synthesized were coated on glass slides by a dipping method. The prepared film surfaces were characterized by the measurement of water contact angles and electron spectroscopy for chemical analysis(ESCA). The behavior of platelet adhesion on the control PBLG and PLG-*g*-PEG film surfaces was examined by a scanning electron microscope(SEM). It was observed that the platelet adhesion on the film surfaces decreased with increasing PEG chain length of PLG-*g*-PEGs. The PLG-PEG6 film surface was effective for the prevention of platelet adhesion, probably due to the increased hydrophilicity and mobility of PEG chains on the surface.