Shear and elongational behavior of modified PC with chain extender

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Abstract. The purpose of this research is to modify the elongational flow behavior of polycarbonate (PC). PC is one of the engineering polymer which has outstanding mechanical, optical, electrical and thermal properties. PC is linear polymer and an improvement of the melt strength of PC is required in some applications. We modified melt-polymerized PC by incorporating reactive agent (chain extender). The modification enhanced storage modulus G' as increasing content of the chain extender, while the loss modulus G" did not show such significant change. The modified PC did not exhibit thermorheological simplicity. Furthermore, the modified PC showed noticeable increase of the stress under elongational flow which is never expected for standard PC.

Keywords: Polycarbonate, rheology, elongational viscosity, chain extender.
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INTRODUCTION

Polycarbonate (PC) is one of engineering plastics and widely used in wide range of applications which required high stiffness and toughness. PC is one of linear polymers and therefore difficult for large size blow molding and foaming. In this study our aim is to enhance the melt rheology of PC which is melt-polymerized PC by an introduction of chain extending agent.

RESULTS AND DISCUSSION

Standard PC and chain extender was mixed in an internal mixer. The dynamic viscoelasticity measurements were carried out at 210 ~ 270 °C. Figure 1 shows the storage modulus *G'* of unmodified PC00 and modified PC03~10 (0.3~1.0 wt% of chain extender) at 250 °C. As increasing the content of the chain extender *G'* increased at low frequency region. The time-temperature superposition was not valid for all the modified PCs. The loss angle δ was plotted as a function of absolute value of complex modulus. In case of PC00 the curve was smoothly decreased from δ ~ 90° to 30° and all the curves at various temperatures were superimposed on a single curve without any sift factor. On the other hand the modified PC03 and PC05 indicated each different curve at low complex modulus depending on the temperature, while the curves at high complex modulus lied on top of each other. Furthermore, for PC10 the curves measured at various temperatures did not exhibit any overlapping behavior.

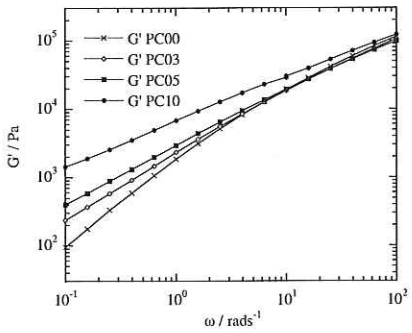

FIGURE 1. Storage modulus *G'* of unmodified (PC00) and modified PCs (PC03~10) at temperature of 250 °C.

We further examined the elongational flow behavior at constant strain rates and temperature of 250 °C. PC00 showed a smooth increase of elongational viscosity with time. The viscosity curves showed strain rate independency. The elongational viscosity of the modified PC03 indicated a slight deviation from the linear viscosity at high strain rate. We should note that PC05 and PC10 showed significant increase of the viscosity, so-called strain hardening at large strain. We considered that the unusual rheological behavior can be attributed to the change of molecular architecture and a presence of more than one branching points in a molecule with high molecular weight.