

## Solvent Effect of Photoinduced Living Cationic Polymerization of Isobutyl Vinyl Ether

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### Abstract

Major factors including solvent and reaction temperature in the cationic polymerization of isobutyl vinyl ether (IBVE), photoinduced in the presence of diphenyliodonium iodide (DPII) zinc iodide in toluene/diethyl ether mixed solvent has been investigated. It was found that the living nature of the propagating species and the tacticity of the resulting polymer is significantly dependent on these factors. The addition of diethyl ether (DEE) results in not only the loss of the cationic living nature but also decrease in the isotactic content.

### Introduction

In our previous report, we reported photoinduced living cationic polymerization of IBVE in the presence of DPII and  $ZnI_2$  in toluene, a non-polar solvent.

In this study, we report the effect of solvent polarity on the living nature and the tacticity of the resulting polymer in photoinduced living cationic polymerization of IBVE.

### Experimental

Polymerization samples for the irradiation were prepared on vacuum line. DPII and  $ZnI_2$  were thoroughly dried under reduced pressure on a vacuum line and sealed off after several repeated freeze-thaw cycles. A 500W high-pressure mercury lamp (Ushio UI-501-C) was used as the light source for the photo-irradiation, carried out at  $-78^\circ C$ . After certain period of the reaction, the polymer was isolated by precipitation in large amount of ammoniacal methanol solution.

The  $\overline{M}_n$  and MWD of polymers were determined by gel permeation chromatography (Spectra-Physics SP8430) using tetrahydrofuran as the eluent ( $10^5$ ,  $10^4$ ,  $10^3$  Å polystyrene gel columns in series. Flow rate: 1.0mL/min). Polystyrene standard was used for the calibration.

$^{13}C$  NMR spectra of the produced polymers were recorded in  $CDCl_3$  at  $40^\circ C$  on a Varian Unity INOVA400, operating at 100 MHz.

### Results and discussion

The rate of polymerization increases as DEE content in the mixed solvent increases. The linear dependence of  $\overline{M}_n$  on % conversion gradually decreases as the content of DEE in the mixed solvent increases, showing the living nature of the system, where chain transfer or termination is absent. The best results, i.e., the highest rate of polymerization without loss of the linear dependence of  $\overline{M}_n$  on % conversion was obtained when the polymerization is carried out in a mixed solvent of toluene/DEE (90/10 v/v).

The meso content of the resulting polymer increases as temperature and content of polar solvent in the mixed solvent decreases. ( $m=62-75\%$ )

### Conclusions

It was found that the addition of polar solvent results in the loss of living nature and reduction of the meso content of the resulting polymer in the photoinduced living cationic polymerization of isobutyl vinyl ether.

### References

1. S. Kwon, Y. Lee, H. Jeon, and S. Mah, J of the Korean Fiber Society, 39,377,2002
2. M. Ouchi, M. Sueoka, M. Kamigaito and M. Sawamoto, J Polym Sci: Part A Vol. 39, 1067-1074(2001).

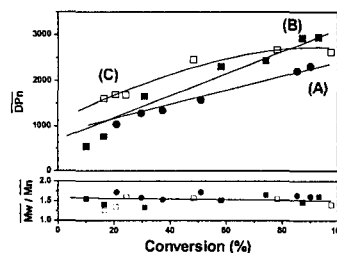


Fig. 1. Plots of % Conversion vs  $\overline{M}_n$  and MWD in the polymerization of IBVE,  $[M]=1.42M$ ,  $[DPII]=0.907mM$ ,  $[ZnI_2]=1.160mM$ , Solvent: (A) Toluene (100%), (B) Toluene/DEE (90/10 v/v%), (C) DEE (100%).