Refractive index of polystyrene at 5461Å in the temperature range 30 to 260K

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A low temperature version of the Abbé refractometer[1] has recently been constructed[2] and used to measure the refractive index of liquid and solid argon at temperatures down to 35K. The reference prism of the refractometer was machined in the workshops of Sussex University from Q. 200.5 cross-linked polystyrene supplied by Polypenco Engineering Plastics, Welwyn Garden City and polished flat to 1 fringe by G. Hole and Son Ltd, Brighton.

A self-calibration of the instrument provided the refractive index of polystyrene at a wavelength of 5461Å over the temperature range 30 to 260K with a maximum experimental uncertainty of 0.001, about 0.06%. The refractive index n was fitted to a polynomial $n = A + BT + CT^2 + DT^3$, where T is the temperature in degrees Kelvin, with the coefficients listed in *Table 1.* Selected values of n are listed in *Table 2.*

Table 1 Polynomial coefficients giving refractive index of polystyrene as a function of temperature with T in degrees kelvin

Coefficients	Variance
$A = 1.6200$	0.60149×10^{-5}
$B = 0.806459 \times 10^{-4}$	0.47040×10^{-8}
$C = -0.126896 \times 10^{-5}$	0.30728×10^{-12}
$D = 0.261742 \times 10^{-8}$	0.17249×10^{-17}

$n = A + BT + CT^2 + DT^3$

Table 2 Refractive index of polystyrene

Temperature, T (K)	Refractive index, n	Temperature, T (K)	Refractive index, n
30	1.6214	160	1.6112
40	1.6214	180	1.6087
60	1.6209	200	1.6063
80	1.6197	220	1.6042
100	1.6180	240	1.6025
120	1.6159	260	1.6012
140	1.6136		

REFERENCES

1 Longhurst, R. S. 'Geometrical and Physical Optics', Longmans, London, 1957, p 87
2 Sinnock, A. C. to be published

Copolymerization of benzonitrile and propylene oxide initiated by *n*-butyllithium

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INTRODUCTION

It is known that strong acidic and basic catalysts cause dimerization and trimerization of cyano compounds[1]. Kabanov *et al.*[2] reported that stoichiometric complexes of some nitriles with $TiCl_4$ and BF_3 polymerized through the cyano bond giving a polymer with conjugated bonds in chains. The polymerization of acetonitrile by $ZnCl_2$ was also reported by Oikawa *et al.*[3].

Using sodium methoxide, Johns[4] polymerized succinontrile to *DP*'s of 6–65. On the other hand, Panayotov *et al.*[5] found that the anion radical and dianion of aromatic nitriles was the initiator of the ring opening polymerization of alkylene oxide. The above facts pointed to the possibility of copolymerization of benzonitrile (BzN) and propylene oxide (PO) and in this paper, this reaction was studied using n-butyllithium (n-BuLi) as the anionic initiator.

EXPERIMENTAL

Reagents

Benzonitrile (BzN) and propylene oxide (PO) were distilled over calcium hydride under reduced and atmospheric pressure, respectively, immediately before use. The concentration of commerical n-butyllithium (n-BuLi) used as initiator was determined by Gillman's double titration method[6,7]. THF was refluxed and distilled over sodium. Other solvents were dried and purified by conventional methods.

Copolymerization

The copolymerization was carried out in sealed glass tubes, containing given weights of BzN, PO and THF added in that order. After degassing, the system was cooled in a dry ice–methanol bath, n-BuLi added under nitrogen, the tube degassed, sealed and placed in a thermostat.

The reaction was stopped by adding water and the oil layer was extracted with benzene. The copolymer was precipitated by adding n-hexane, filtered, washed with n-hexane and dried under vacuum to a constant weight.

The copolymer was characterized by elementary analysis and infra-red spectra.

Reaction of propylene oxide with the anionic radical of benzonitrile

The anionic radical of BzN was obtained by reaction with metal sodium in THF at 30°C for 30 min. The polymerization of PO was carried out in THF by heating at 30°C for 4 h.

The poly(propylene oxide) was confirmed by i.r. and elementary analysis.

Reaction of BzN with sodium ethoxide

The oligomerization of BzN was carried out by using sodium ethoxide as catalyst in THF at 30°C for 3 h and the product was confirmed by i.r. and elementary analysis.

Measurements

The infra-red spectrum of the copolymer was measured as KBr pellets