

Supplementary data

**Facile preparation of aliphatic main-chain benzoxazine copolymers
with high-frequency low dielectric constants**

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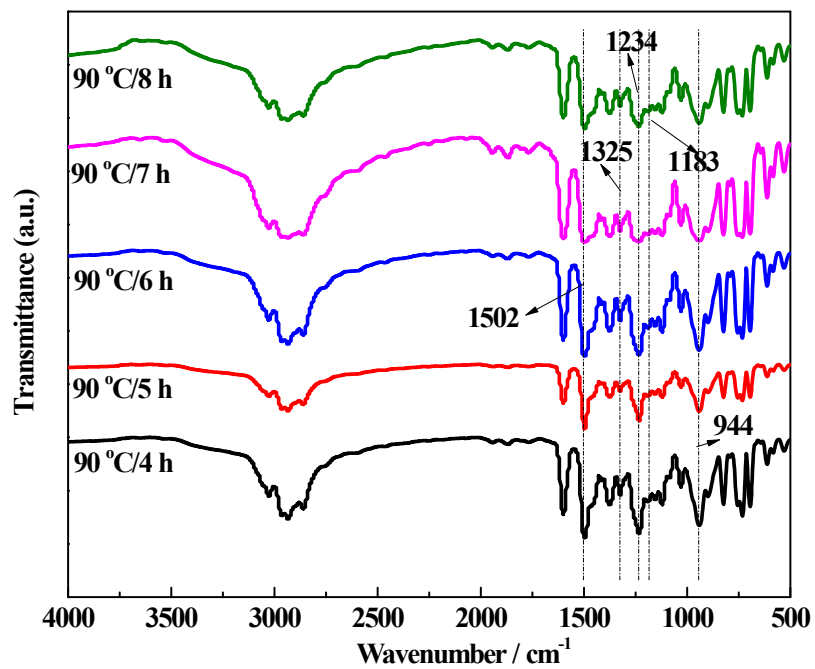


Fig. S1 FTIR spectra of benzoxazine copolymer prepolymer synthesized in toluene at 90 °C.

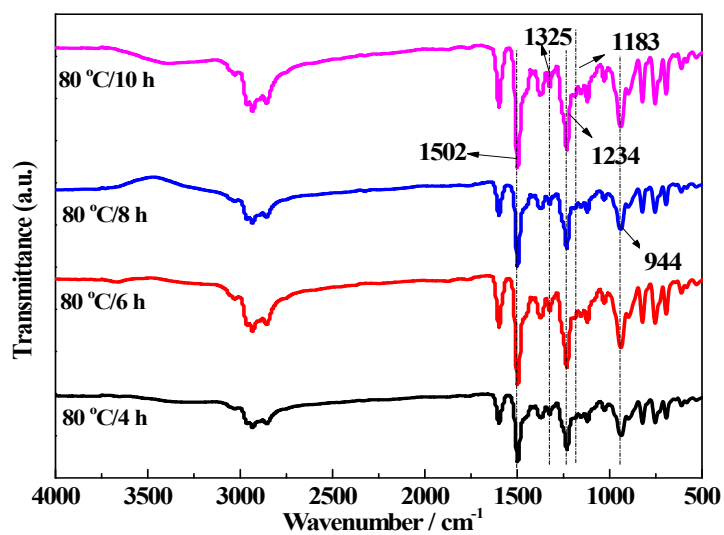


Fig. S2 FTIR spectra of benzoxazine copolymer prepolymer synthesized in toluene/ethanol at 80 °C.

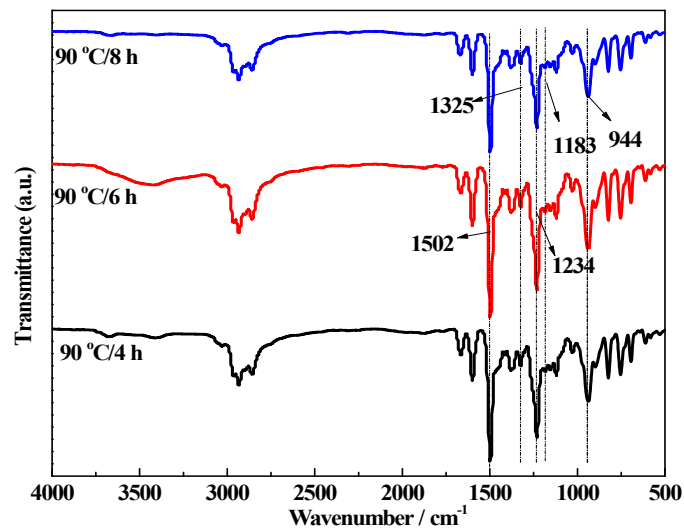


Fig. S3 FTIR spectra of benzoxazine copolymer prepolymer synthesized in toluene/DMF at 90 °C.

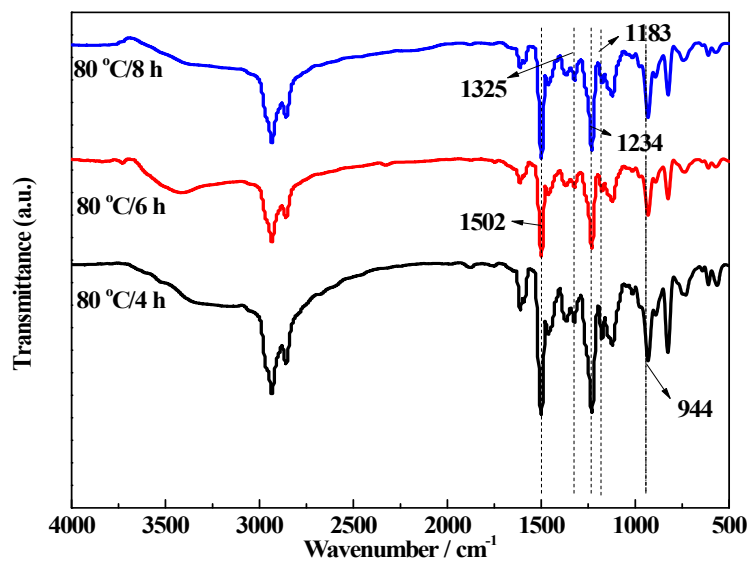


Fig. S4 FTIR spectra of DAH based main-chain benzoxazine oligomer synthesized in toluene/ethanol.

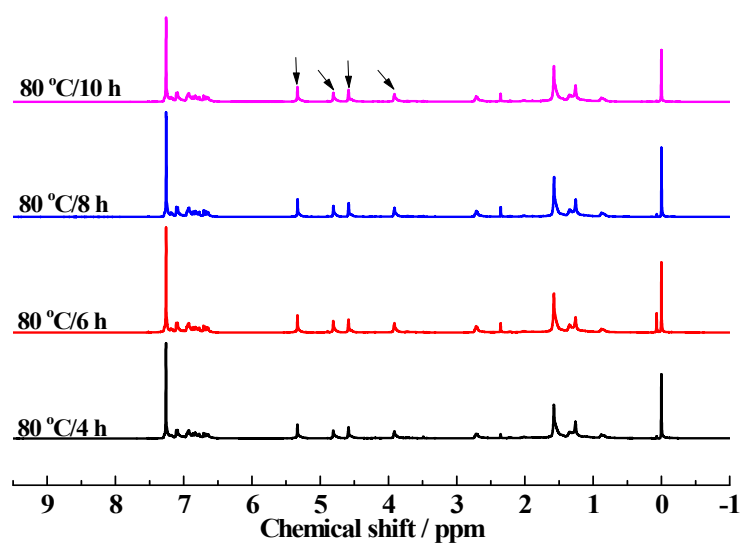


Fig. S5 ¹H-NMR spectra of benzoxazine copolymer prepolymer synthesized in toluene/ethanol at 80 °C.

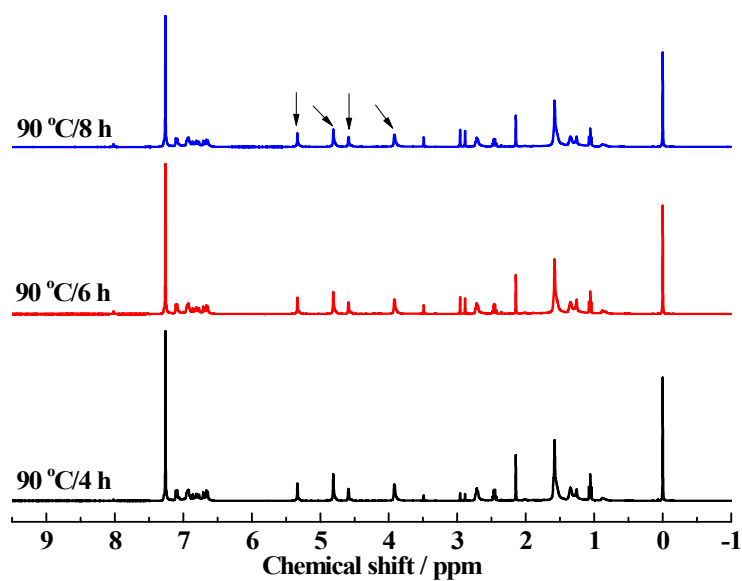


Fig. S6 ¹H-NMR spectra of benzoxazine copolymer prepolymer synthesized in toluene/DMF at 90 °C.

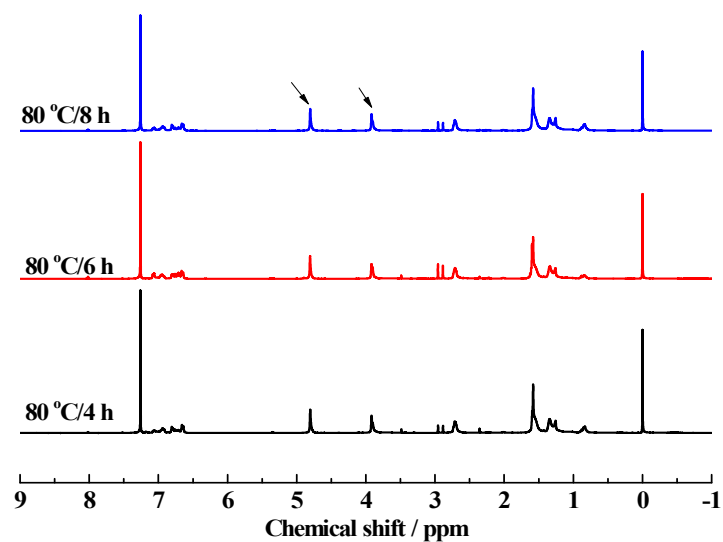


Fig. S7 ¹H-NMR spectra of DAH based main-chain benzoxazine oligomer synthesized in toluene/ethanol.

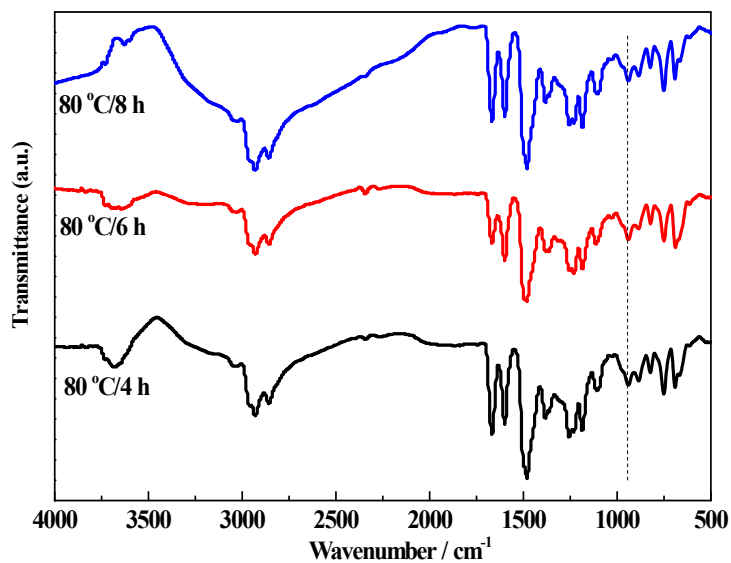


Fig. S8 FTIR spectra of benzoxazine copolymer prepolymer synthesized at 80 °C in toluene after curing.

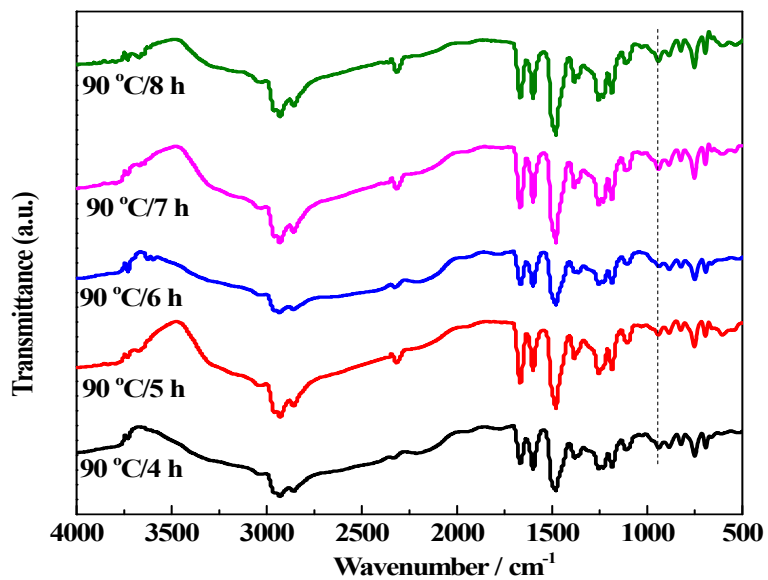


Fig. S9 FTIR spectra of benzoxazine copolymer prepolymer synthesized at 90 °C in toluene after curing.

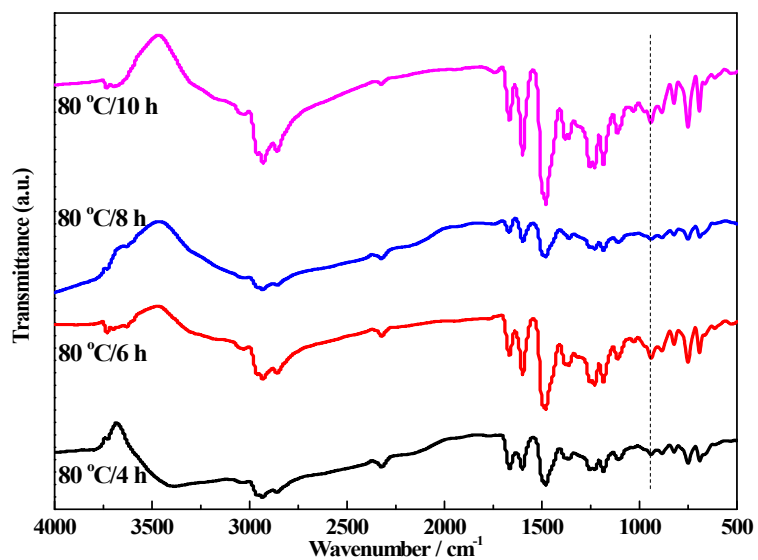


Fig. S10 FTIR spectra of benzoxazine copolymer prepolymer synthesized at 80 °C in toluene/ethanol after curing.

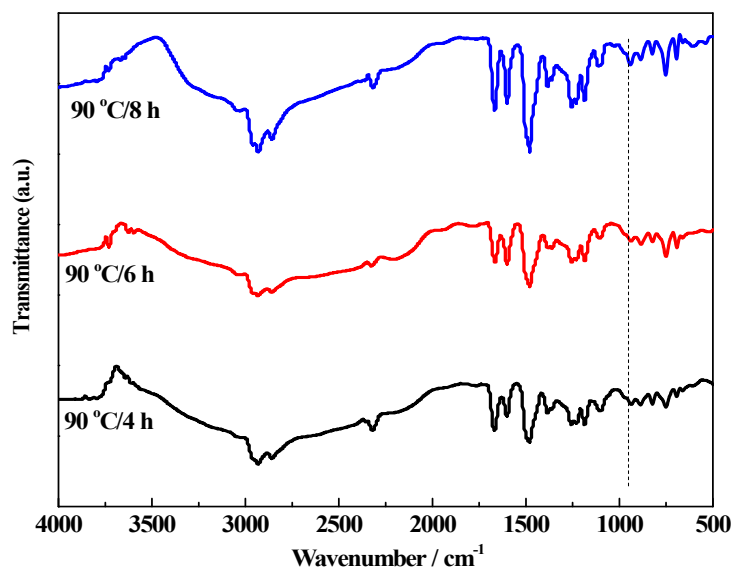


Fig. S11 FTIR spectra of benzoxazine copolymer prepolymer synthesized at 90 °C in toluene/DMF after curing.

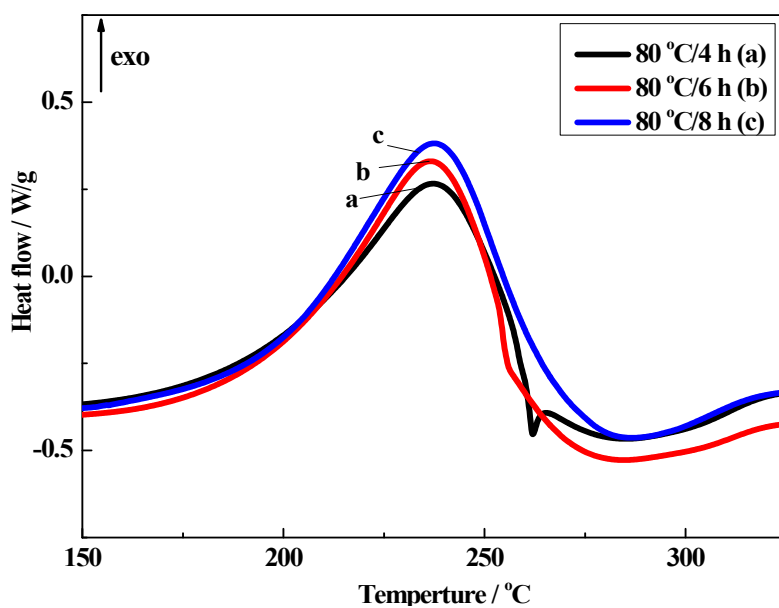


Fig. S12 DSC thermograms of BAH copolymer oligomers synthesized in toluene at 80 °C.

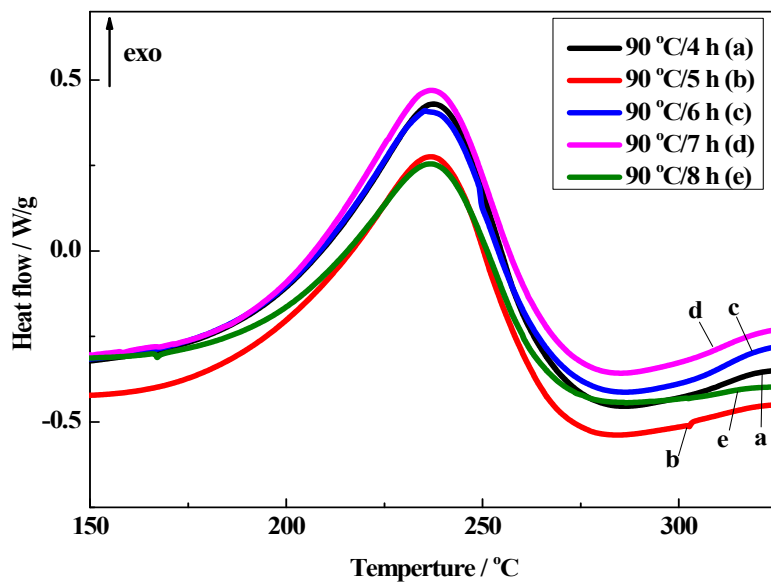


Fig. S13 DSC thermograms of BAH copolymer oligomers synthesized in toluene at 90 °C.

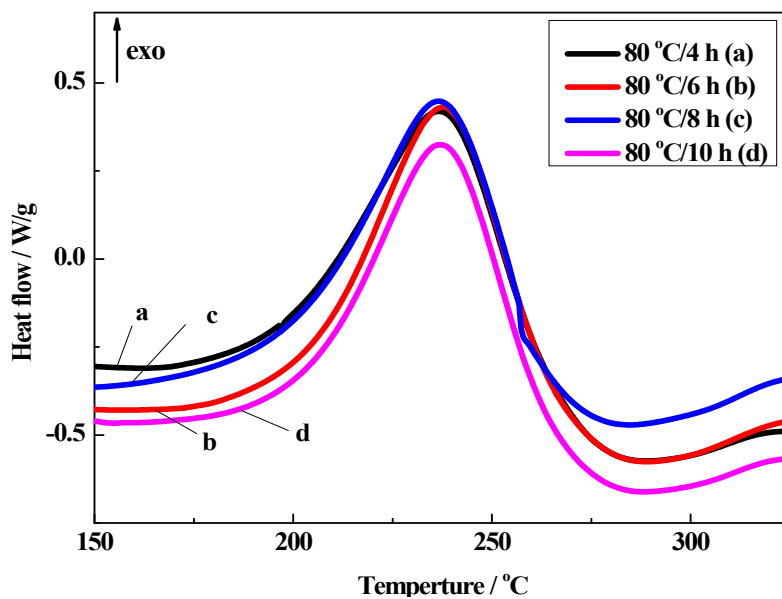


Fig. S14 DSC thermograms of benzoxazine copolymer prepolymer synthesized in toluene/ethanol.

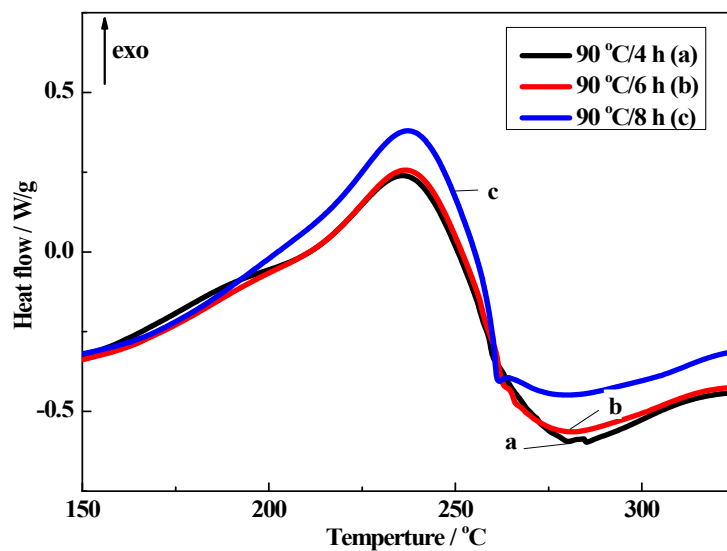


Fig. S15 DSC thermograms of benzoxazine copolymer prepolymer synthesized in toluene/DMF.

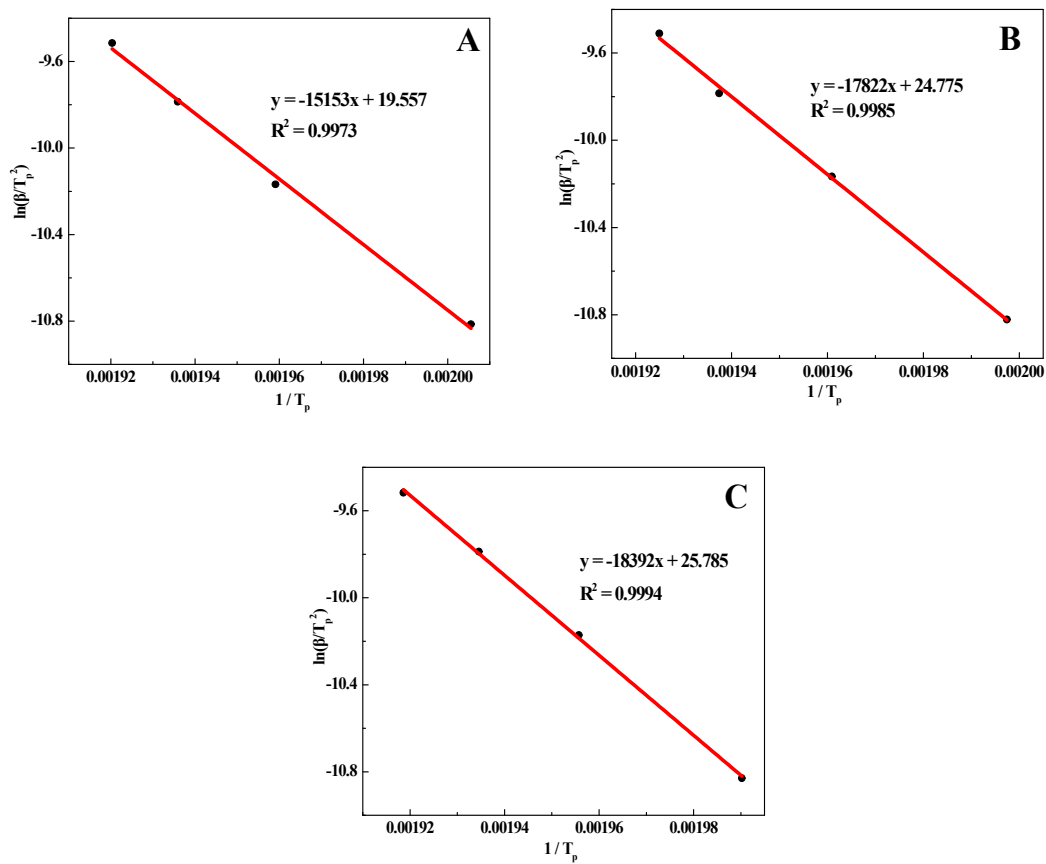


Fig. S16 Kissinger plots of $\ln(\beta/T_p^2)$ and $1/T_p$ for BAH copolymer oligomers synthesized in toluene at 80 °C (A) 4 h, (B) 6 h, (C) 8 h.

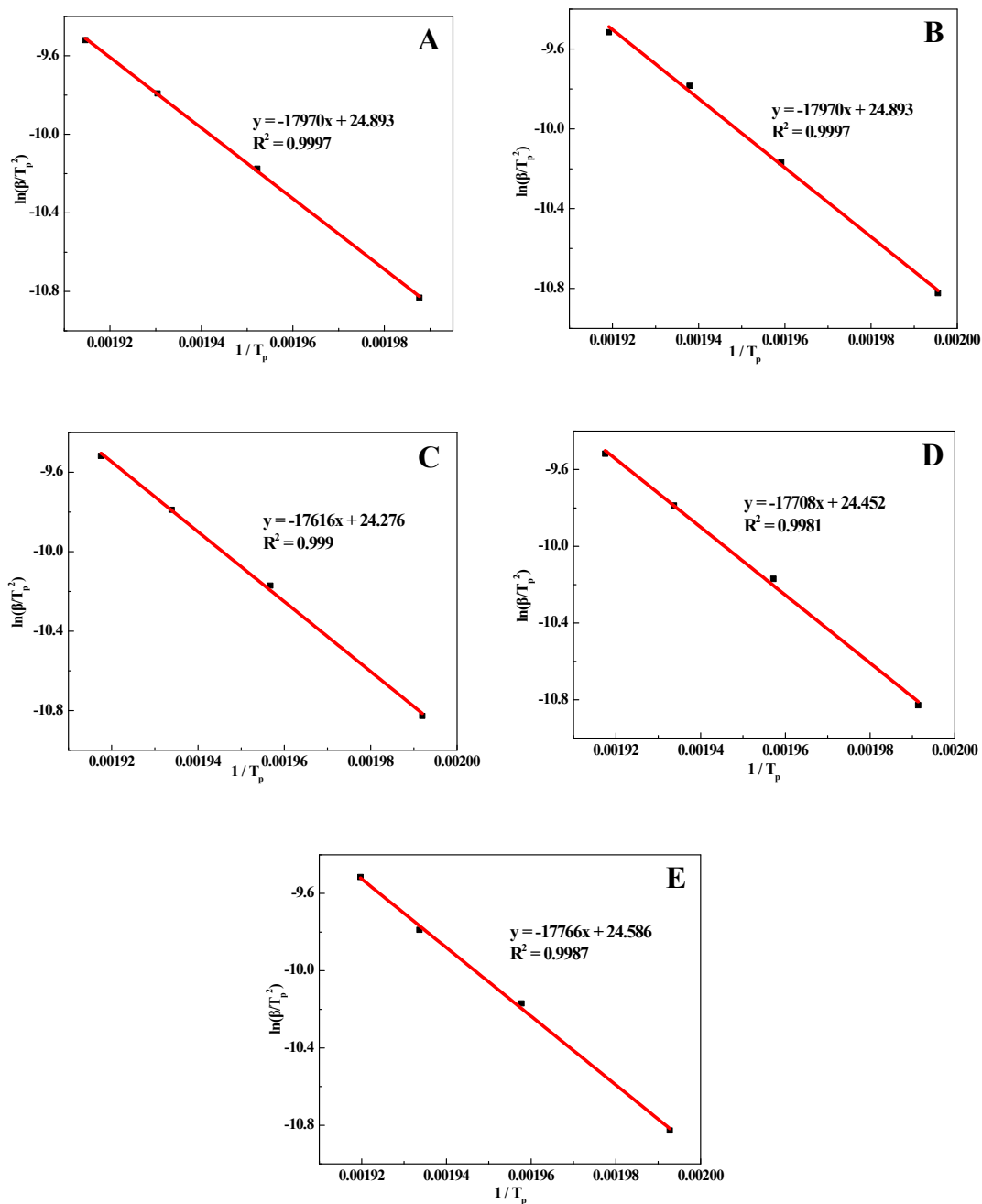


Fig. S17 Kissinger plots of $\ln(\beta/T_p^2)$ and $1/T_p$ for BAH copolymer oligomers synthesized in toluene at 90 °C (A) 4 h, (B) 5 h, (C) 6 h, (D) 7 h, (E) 8 h.

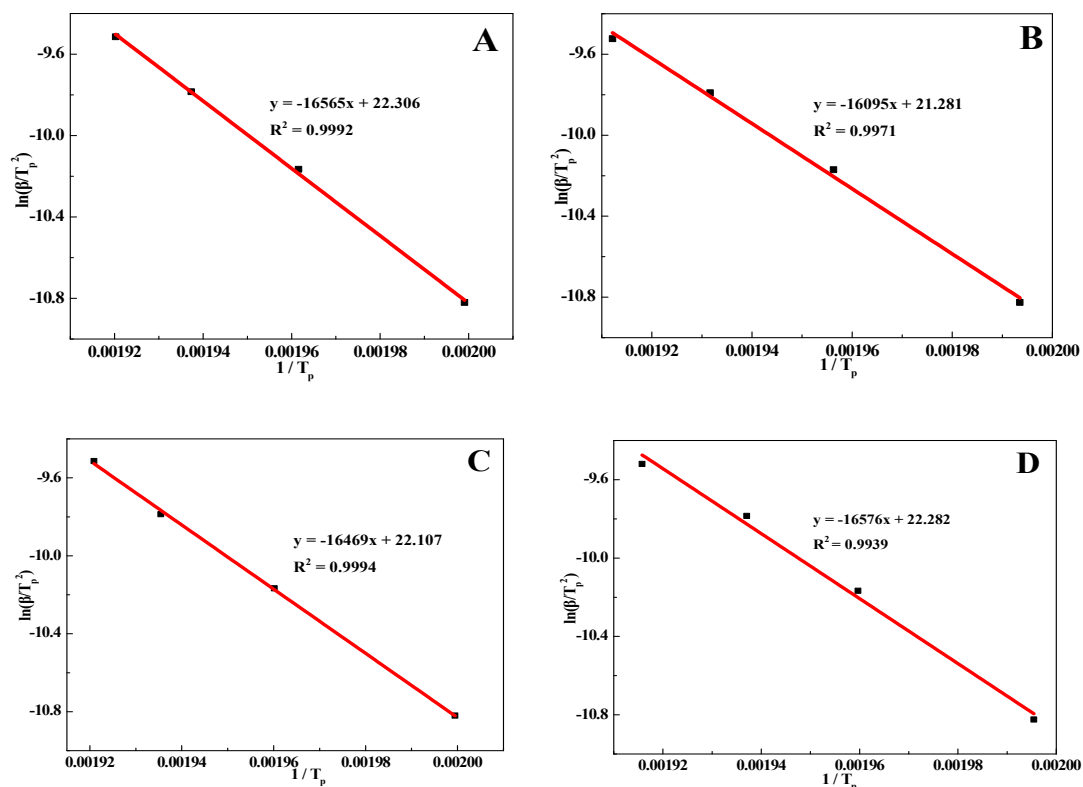


Fig. S18 Kissinger plots of $\ln(\beta/T_p^2)$ and $1/T_p$ for BAH copolymer oligomers synthesized in toluene/ethanol (A) 4 h, (B) 6 h, (C) 8 h, (D) 10 h.

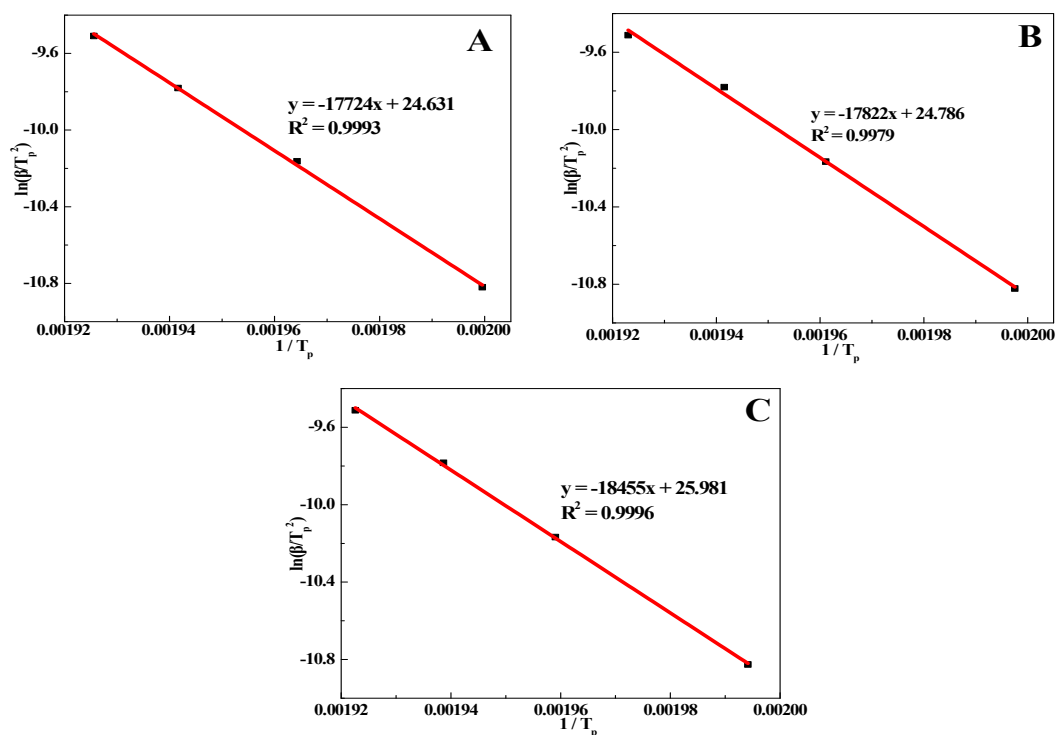


Fig. S19 Kissinger plots of $\ln(\beta/T_p^2)$ and $1/T_p$ for BAH copolymer oligomers synthesized in

toluene/DMF (A) 4 h, (B) 6 h, (C) 8 h.

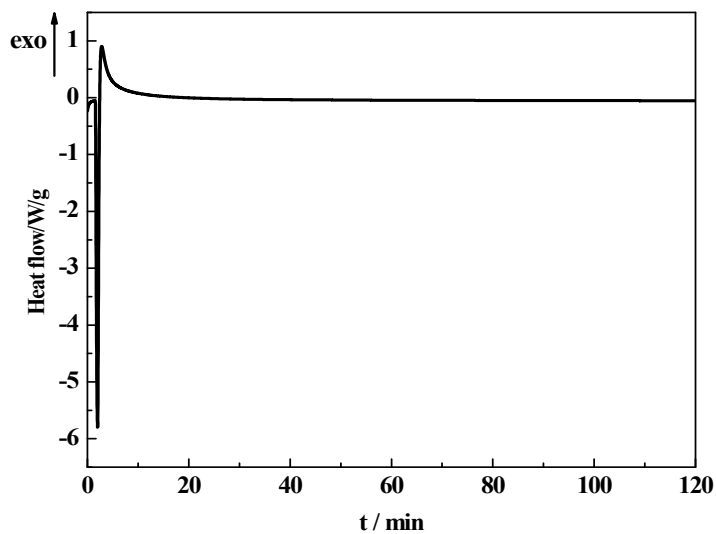


Fig. S20 The curing behavior of BAH-15 copolymer oligomer synthesized in toluene/DMF at 90 °C for 8 h observed by isothermal DSC at 210 °C.

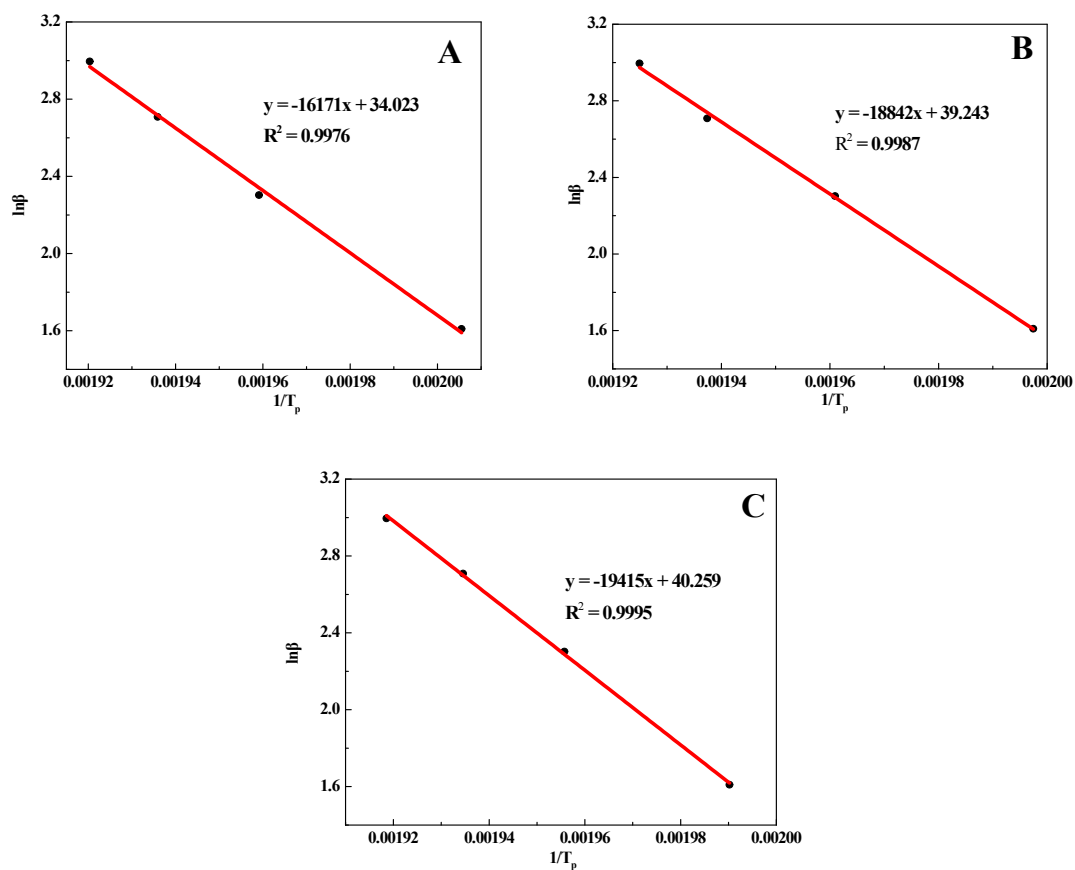


Fig. S21 The Crane plot of $\ln\beta$ and $1/T_p$ for BAH copolymer oligomer synthesized in toluene at 80 °C (A) 4 h, (B) 6 h, (C) 8 h.

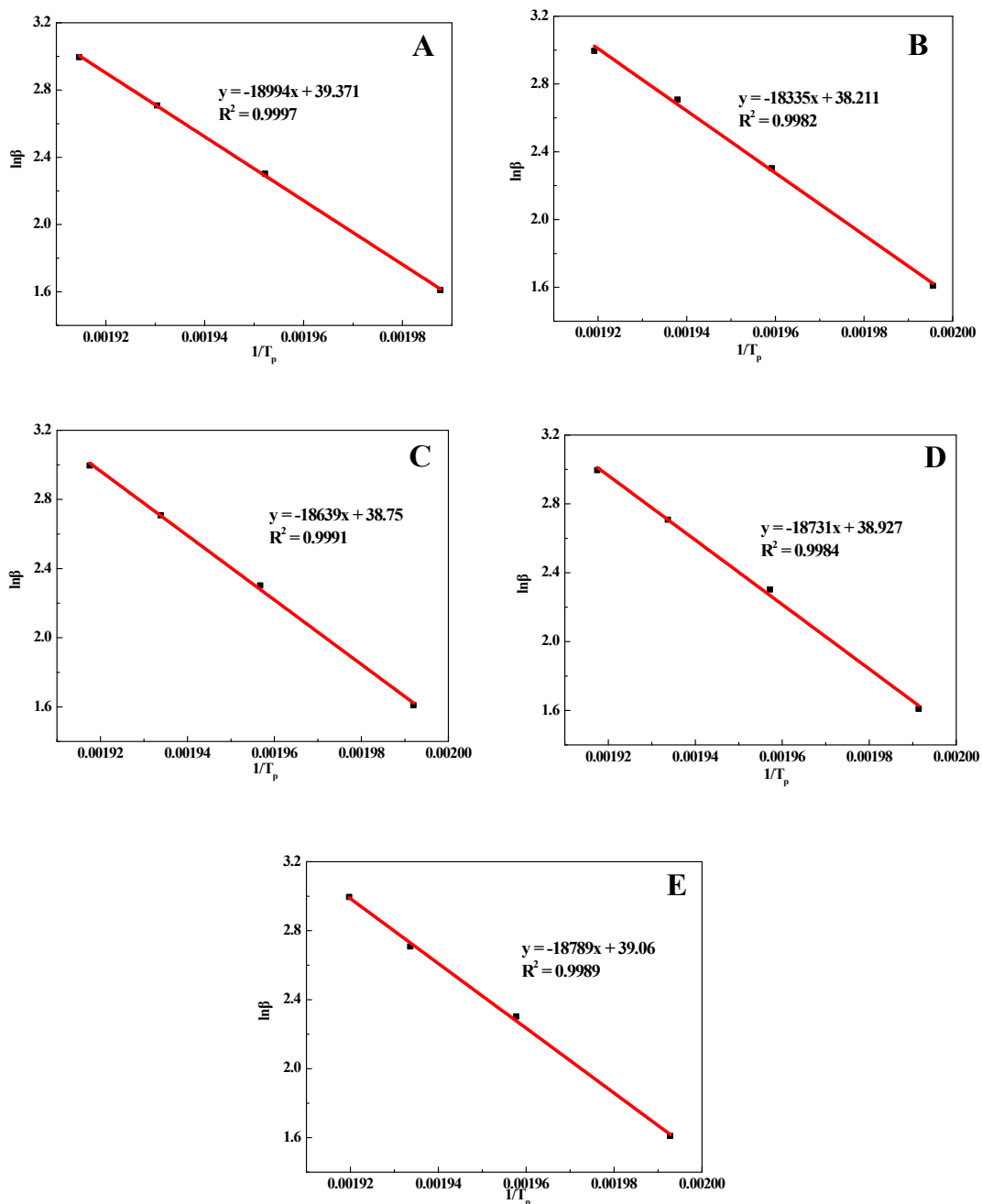


Fig. S22 The Crane plot of $\ln\beta$ and $1/T_p$ for BAH copolymer oligomer synthesized in toluene at 90 °C (A) 4 h, (B) 5 h, (C) 6 h, (D) 7 h, (E) 8 h.

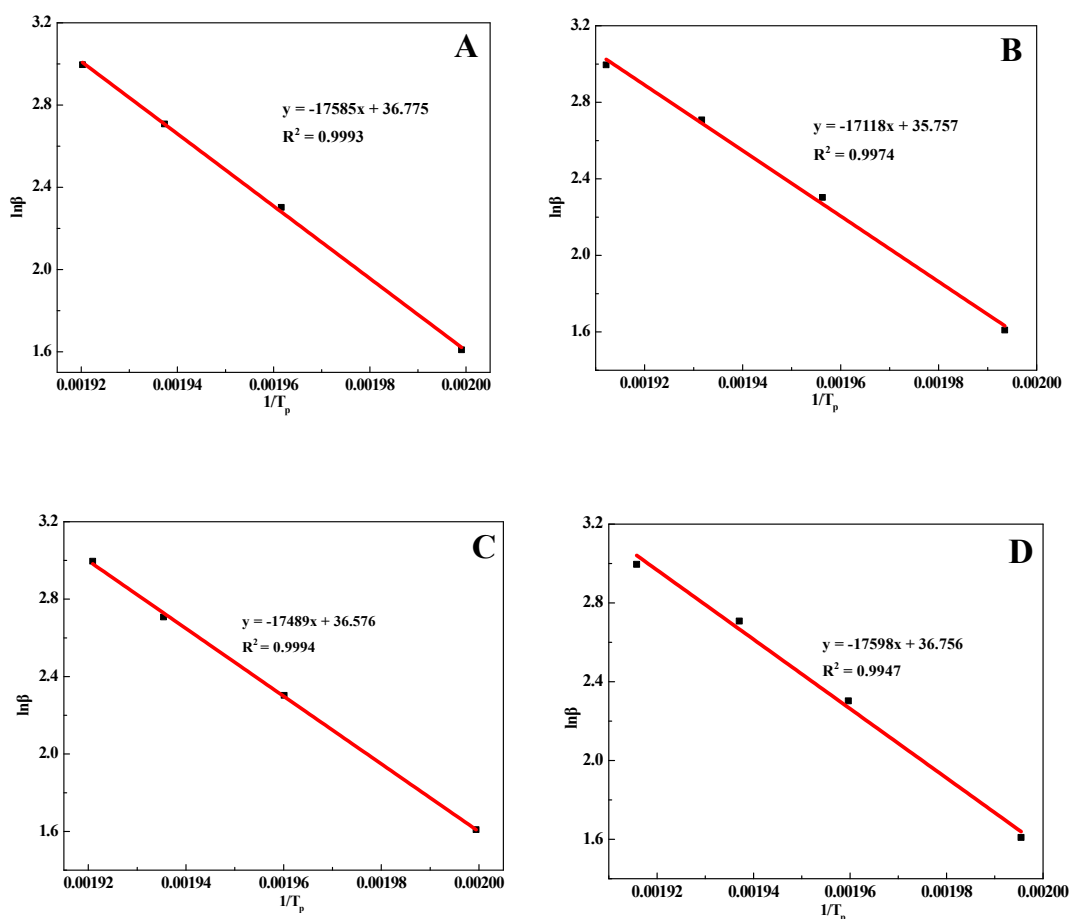
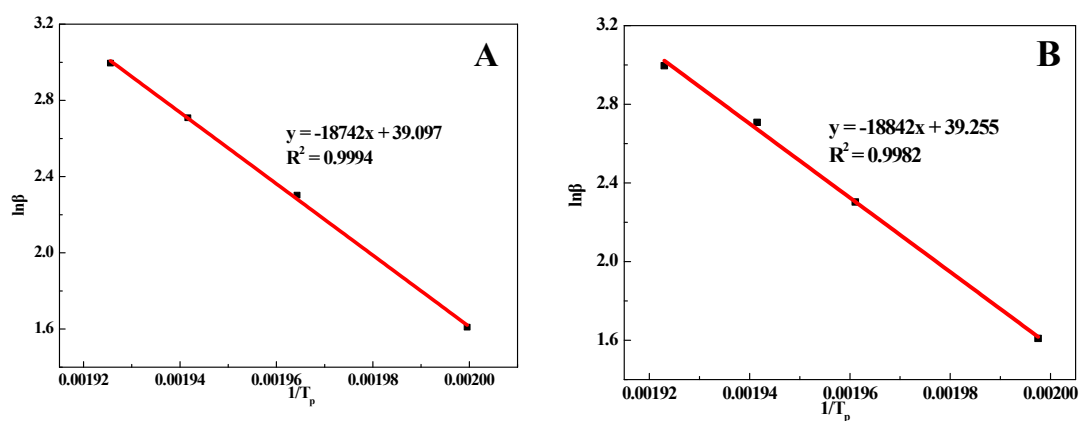


Fig. S23 The Crane plots of $\ln\beta$ and $1/T_p$ for BAH copolymer oligomer synthesized in toluene/ethanol (A) 4 h, (B) 6 h, (C) 8 h, (D) 10 h.



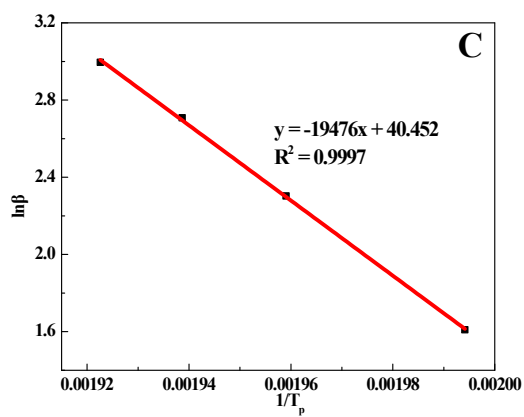


Fig. S24 The Crane plots of $\ln\beta$ and $1/T_p$ for BAH copolymer oligomer synthesized in toluene/DMF (A) 4 h, (B) 6 h, (C) 8 h.