

Supporting information

Syndio- and *cis*-1,4 Dually Selective Copolymerization of Polar Fluorostyrene and Butadiene using Rare-earth Metal Catalysts

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Figure S2. ^1H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 5) (500MHz, CDCl_3 , 25°C).

Figure S3. ^1H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 6) (500MHz, CDCl_3 , 25°C).

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Figure S17. ¹³C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 11) (125MHz, CDCl₃, 25°C).

Figure S18. ¹³C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 12) (125MHz, CDCl₃, 25°C).

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Figure S20. HMBC (¹H detected heteronuclear multiple bond correlation) spectrum of multi-block poly(*p*FS-BD). (125MHz, CDCl₃, 25°C).

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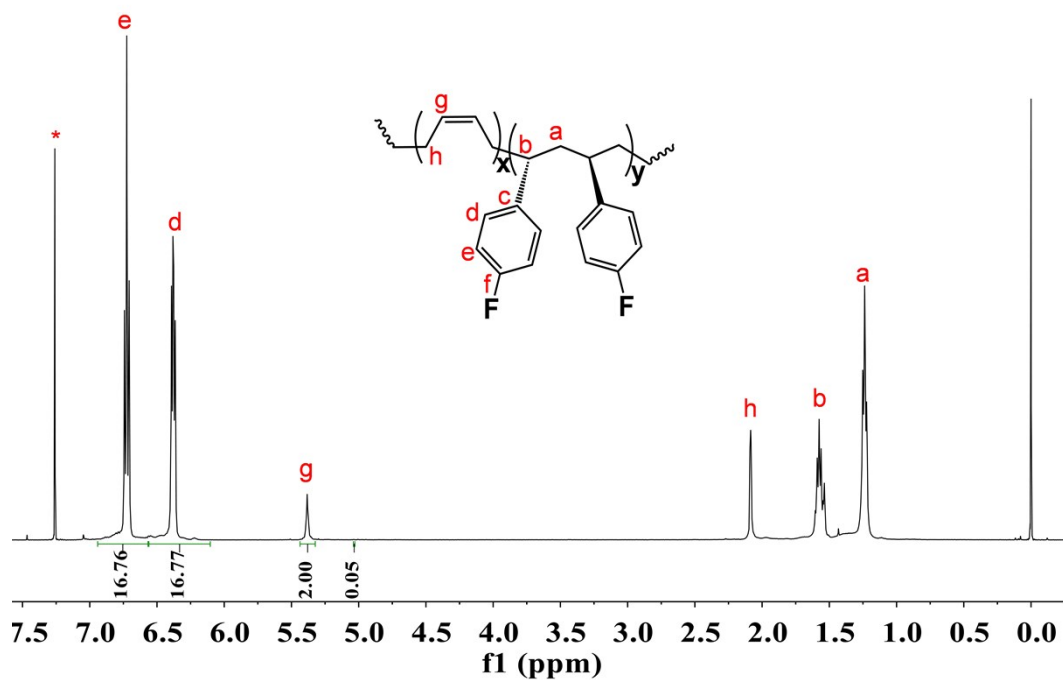


Figure S1. ¹H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 3) (500MHz, CDCl₃, 25°C).

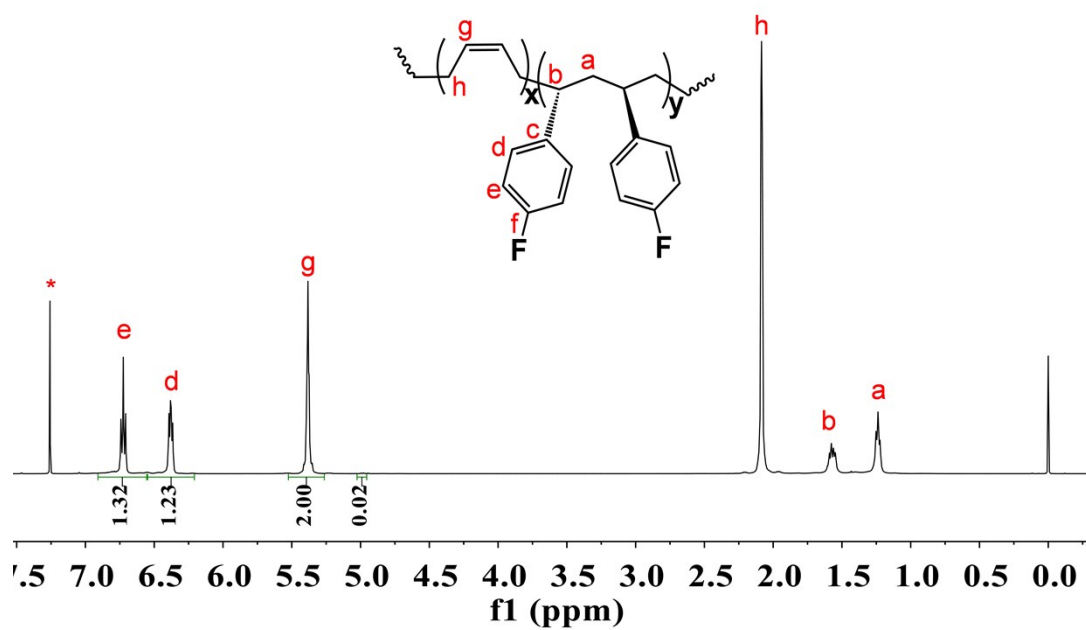


Figure S2. ¹H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 5) (500MHz, CDCl₃, 25°C).

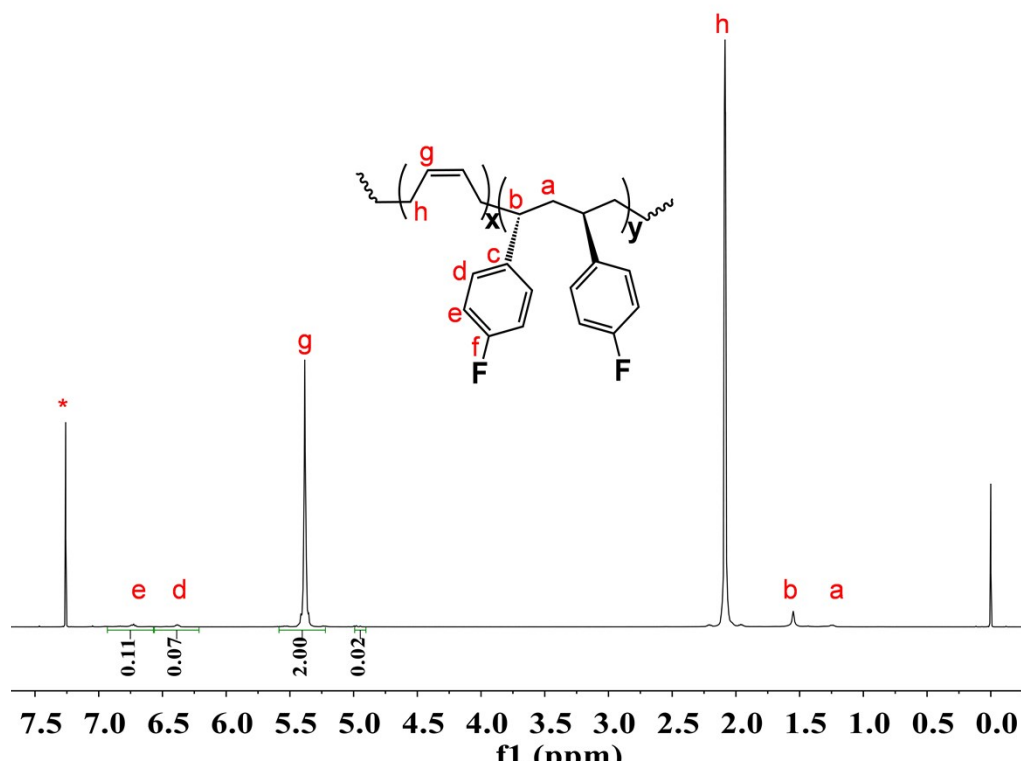


Figure S3. ^1H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 6) (500MHz, CDCl_3 , 25°C).

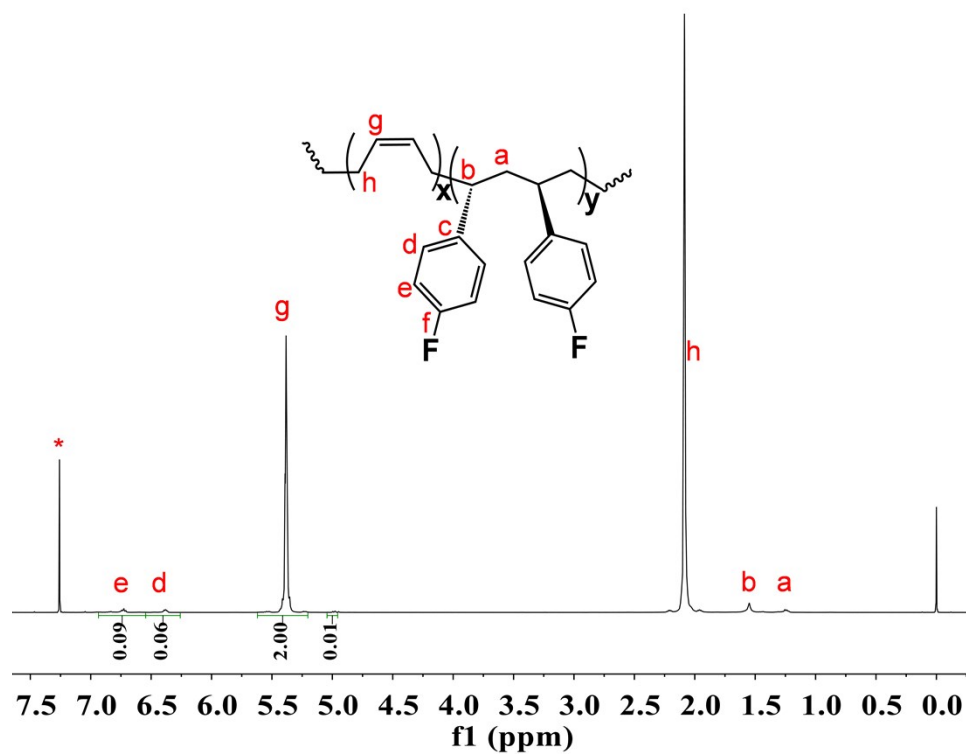


Figure S4. ^1H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 7) (500MHz, CDCl_3 , 25°C).

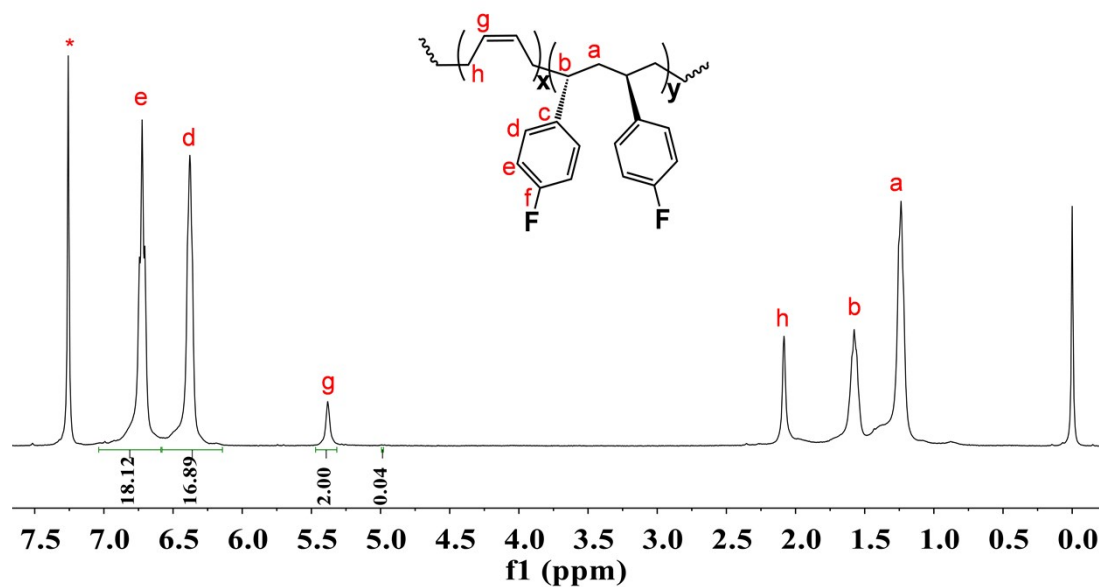


Figure S5. ¹H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 8) (500MHz, CDCl₃, 25°C).

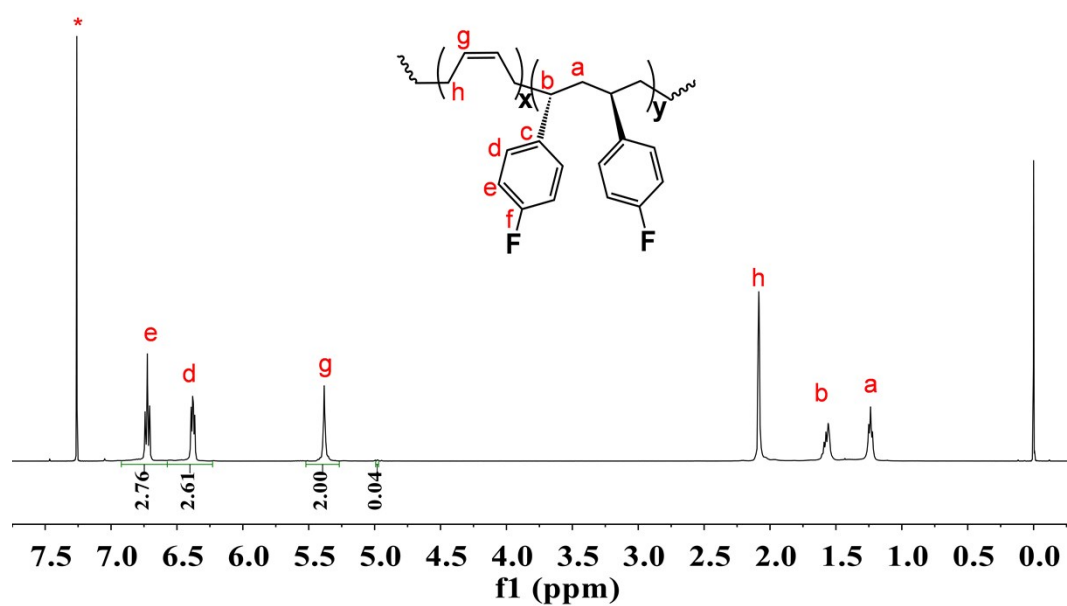


Figure S6. ¹H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 9) (500MHz, CDCl₃, 25°C).

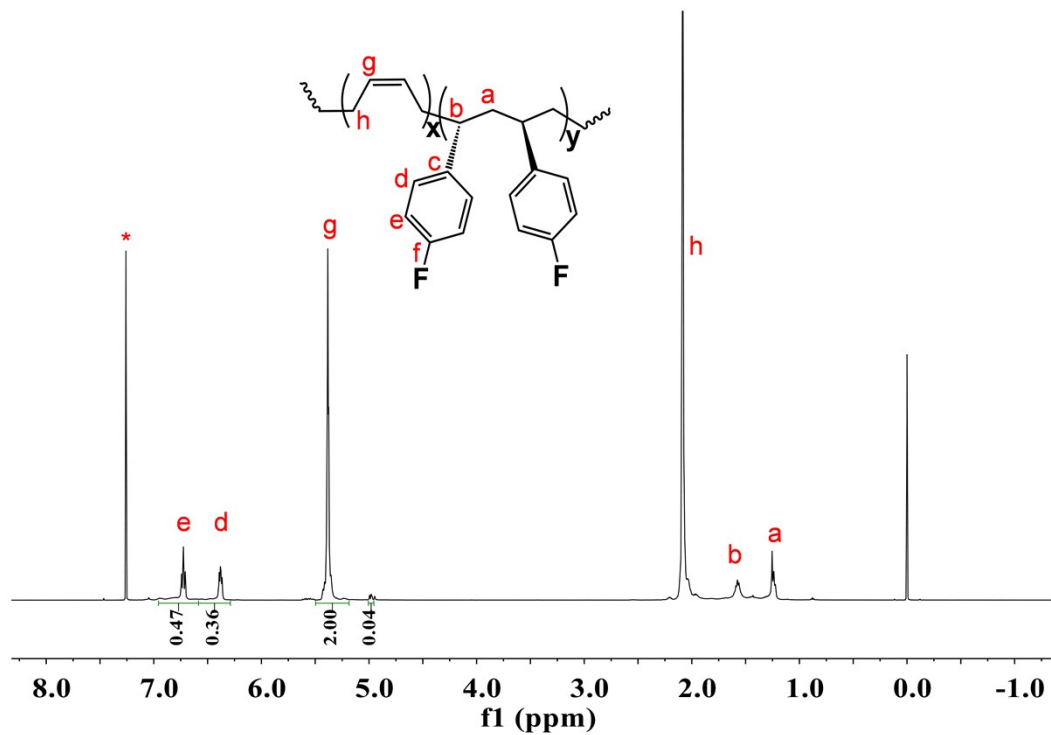


Figure S7. ¹H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 10) (500MHz, CDCl₃, 25°C).

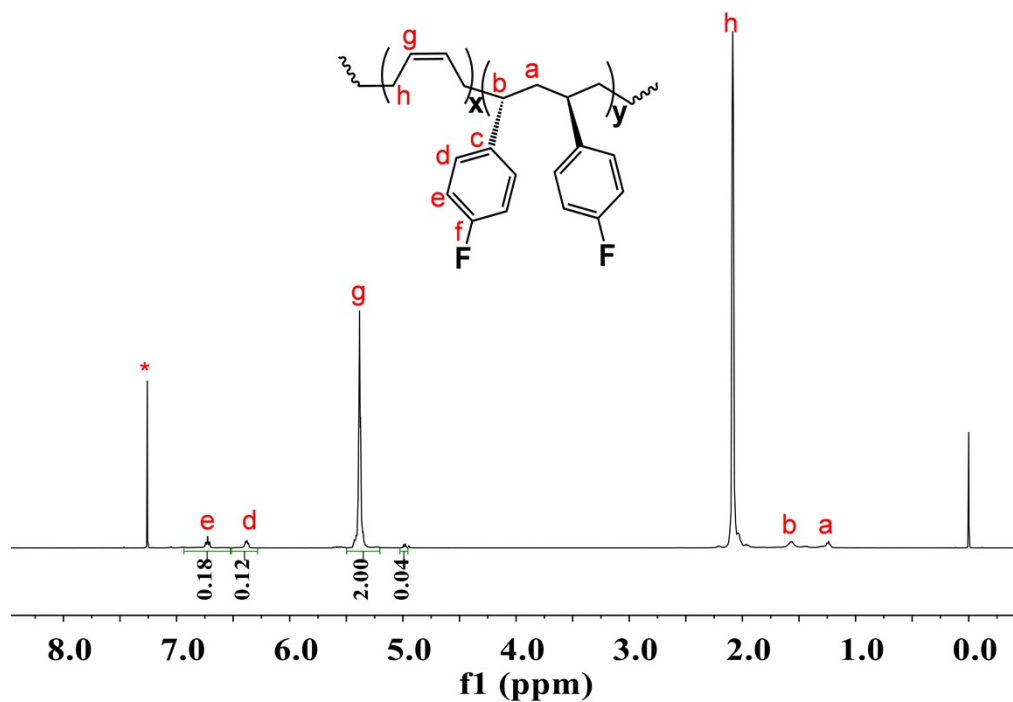


Figure S8. ¹H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 11) (500MHz, CDCl₃, 25°C).

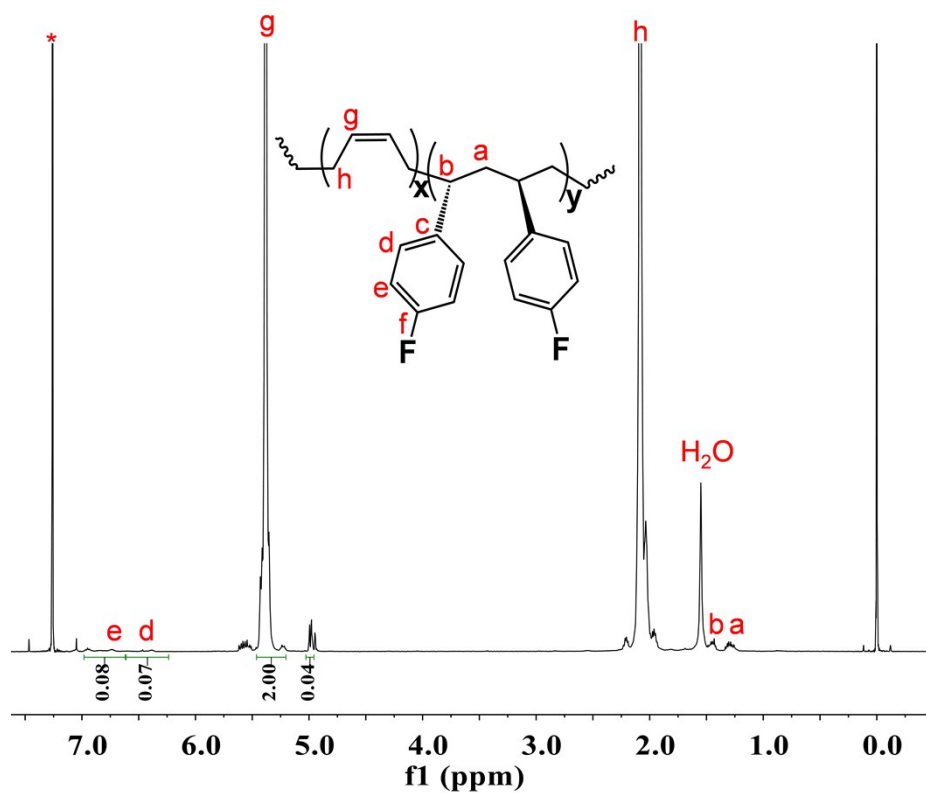


Figure S9. ¹H NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 12) (500MHz, CDCl₃, 25°C).

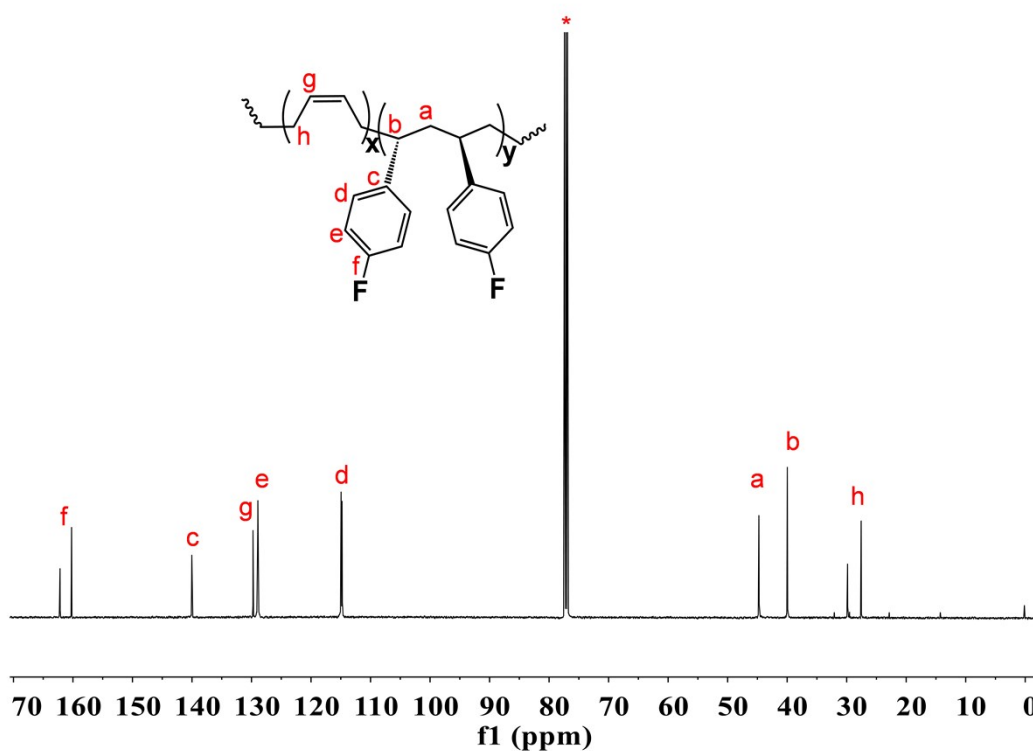


Figure S10. ¹³C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 3) (125MHz, CDCl₃, 25°C).

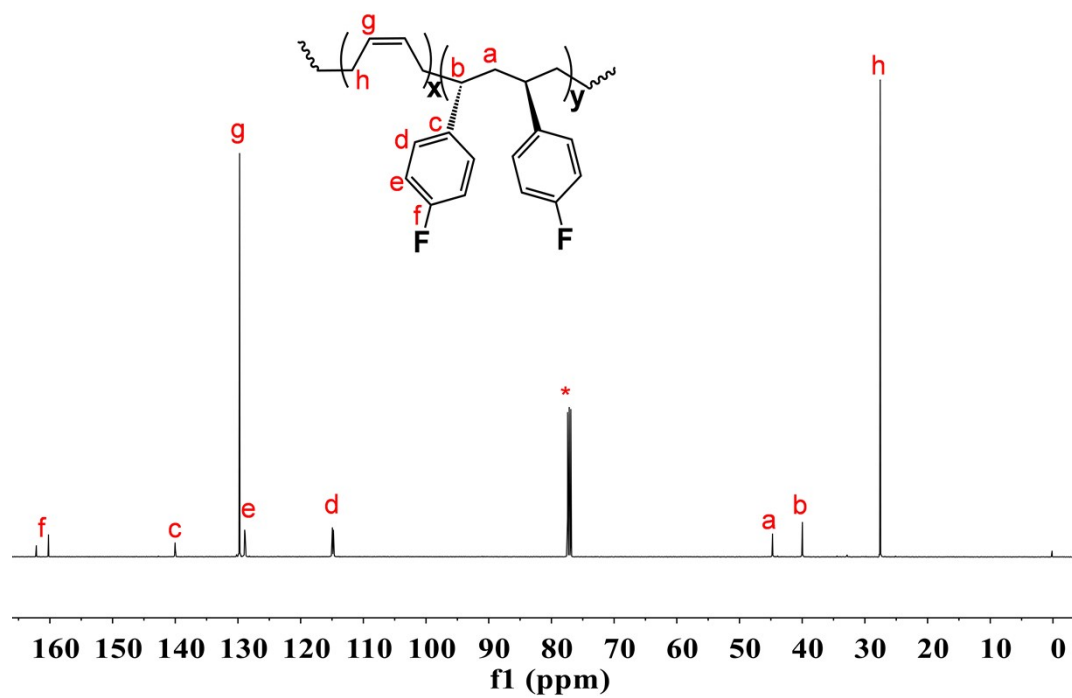


Figure S11. ^{13}C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 5) (125MHz, CDCl_3 , 25°C).

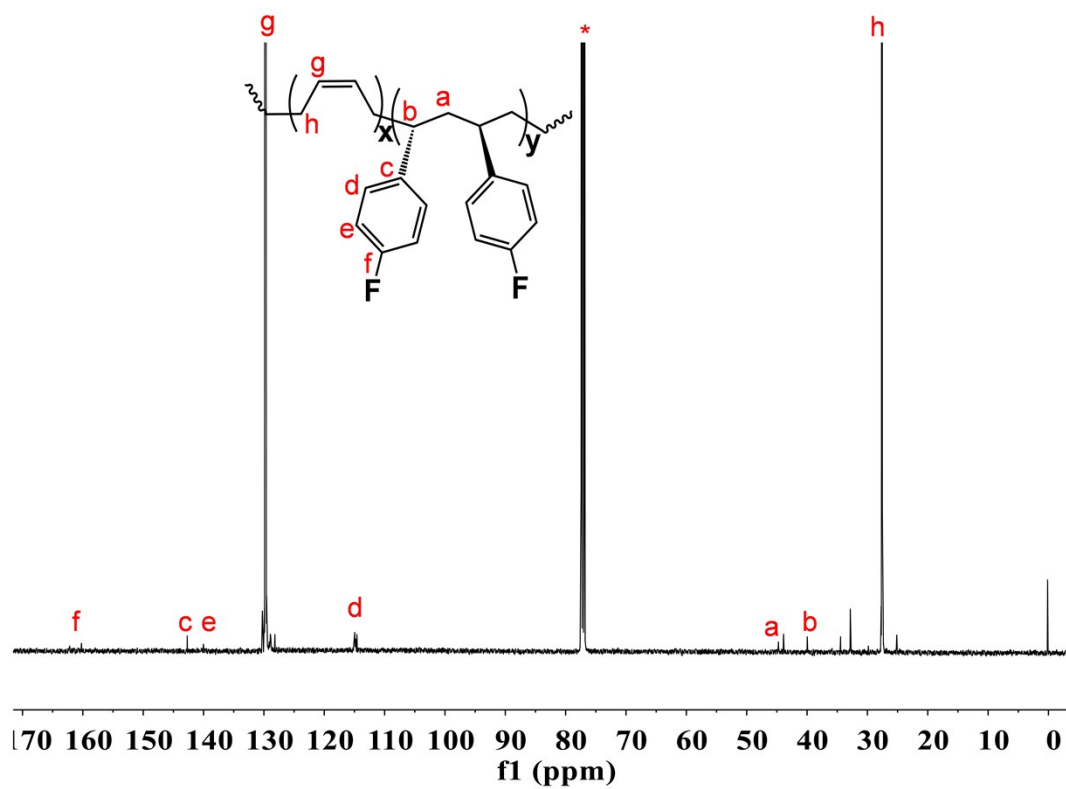


Figure S12. ^{13}C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 6) (125MHz, CDCl_3 , 25°C).

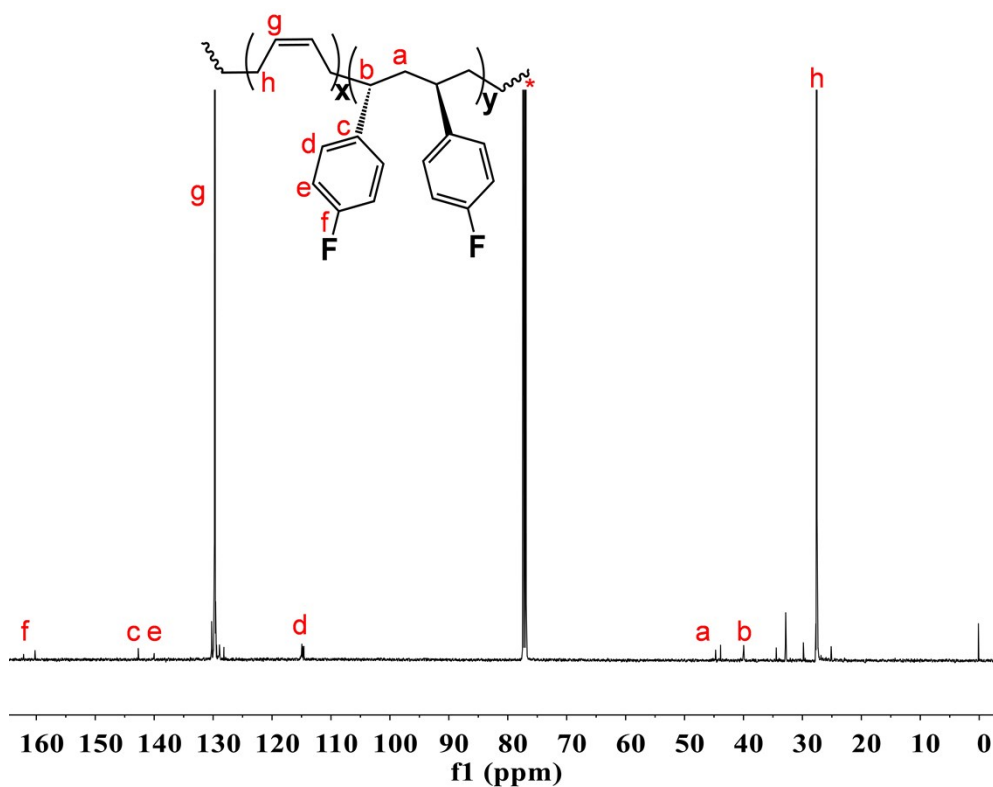


Figure S13. ^{13}C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 7) (125MHz, CDCl₃, 25°C).

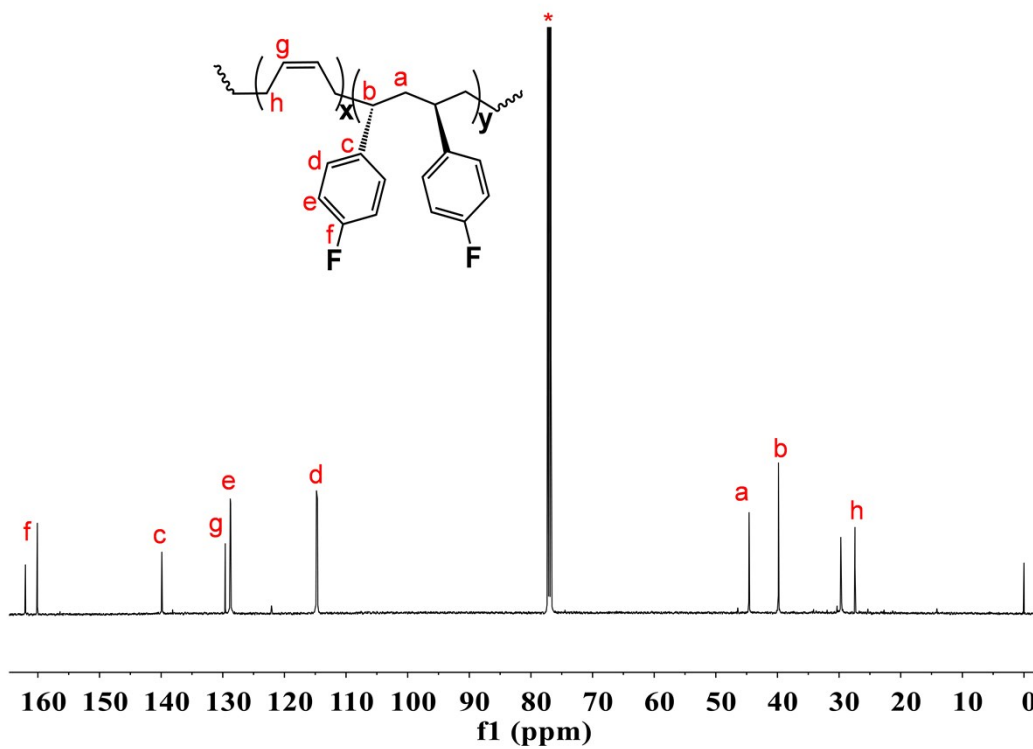


Figure S14. ^{13}C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 8) (125MHz, CDCl₃, 25°C).

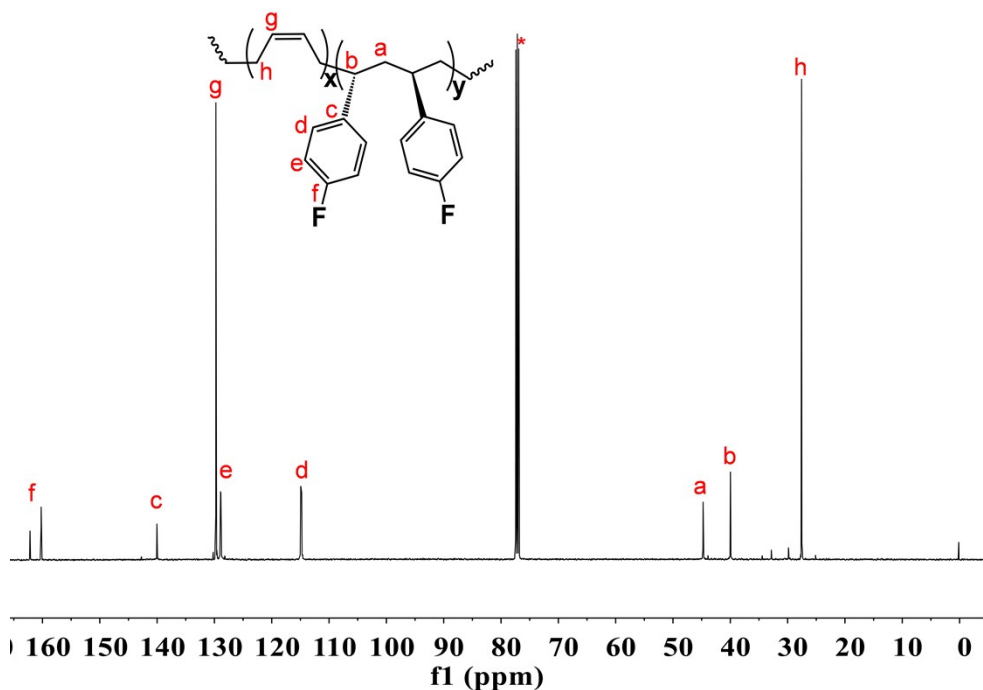


Figure S15. ^{13}C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 9) (125MHz, CDCl_3 , 25°C).

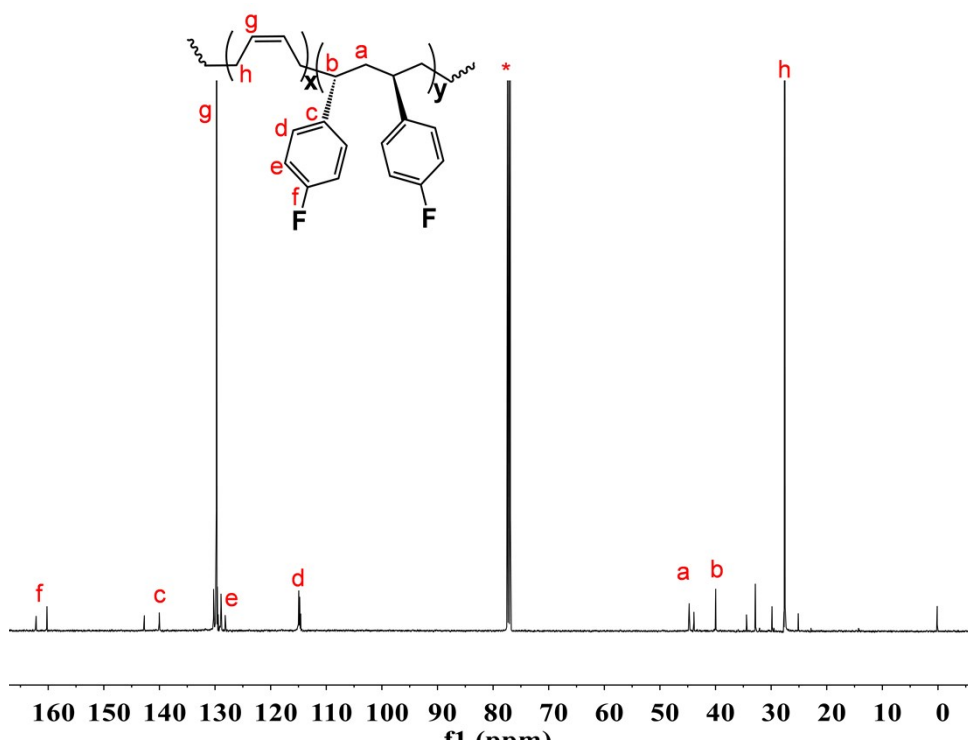


Figure S16. ^{13}C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 10) (125MHz, CDCl_3 , 25°C).

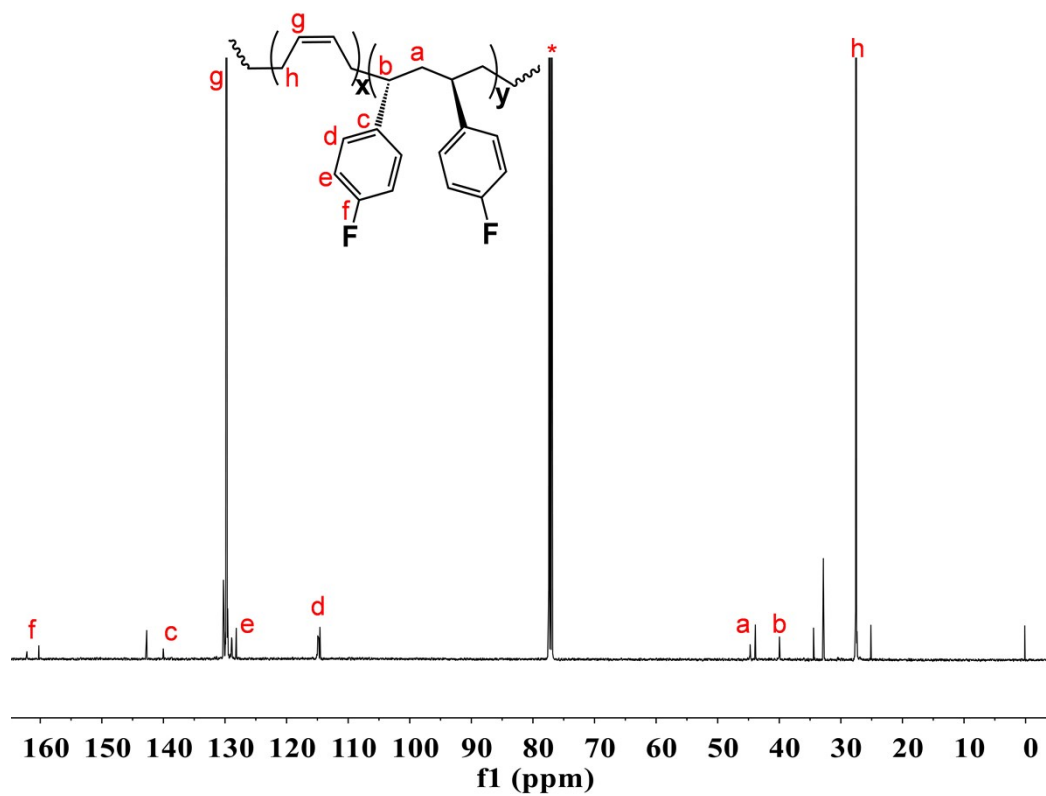


Figure S17. ^{13}C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 11) (125MHz, CDCl_3 , 25°C).

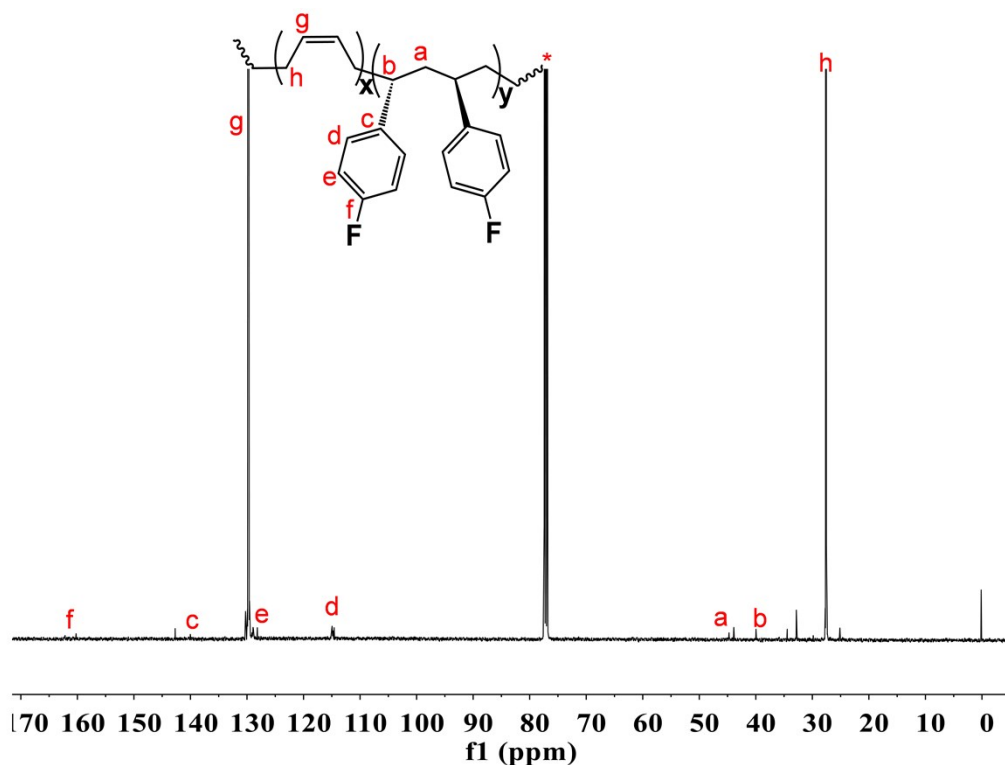


Figure S18. ^{13}C NMR spectrum of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 12) (125MHz, CDCl_3 , 25°C).

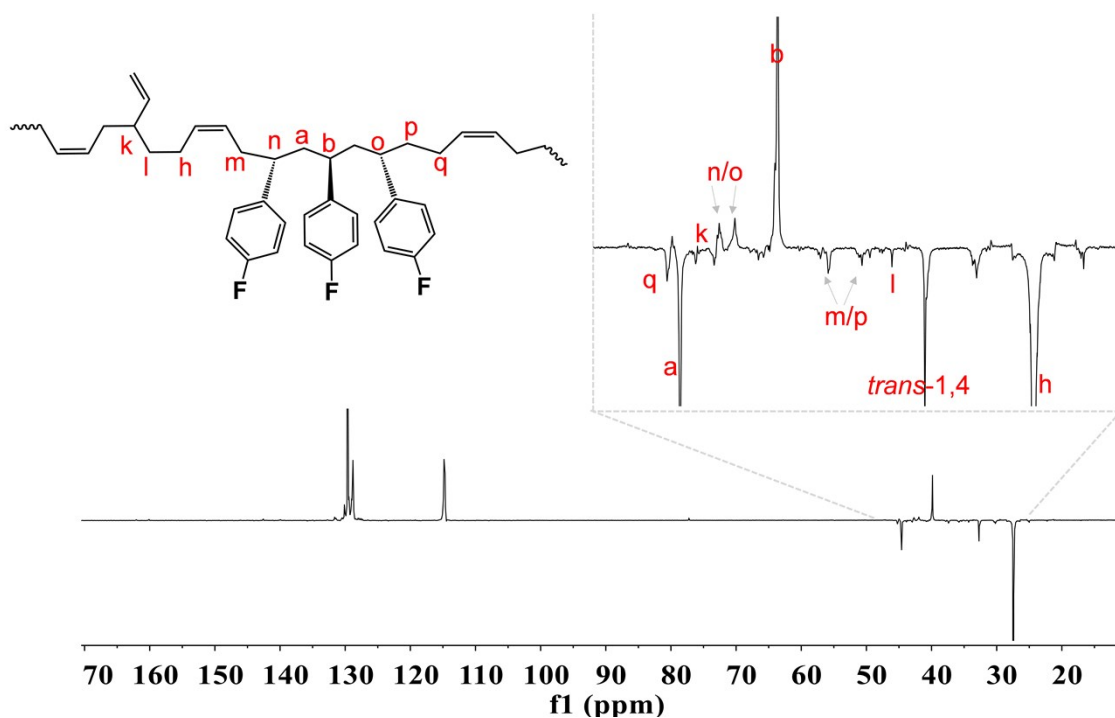


Figure S19. DEPT (distortionless enhancement by polarization transfer) 135 spectrum of multi-block poly(*p*FS-BD). (125MHz, CDCl₃, 25°C).

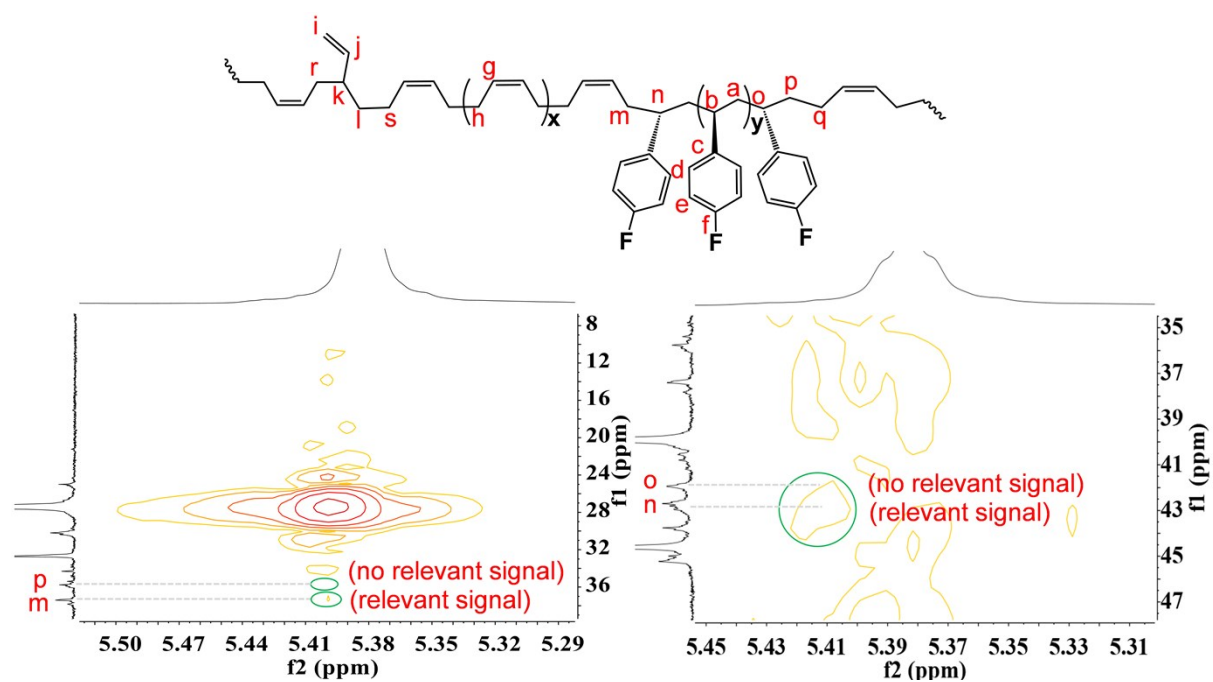


Figure S20. HMBC (¹H detected heteronuclear multiple bond correlation) spectrum of multi-block poly(*p*FS-BD). (125MHz, CDCl₃, 25°C).

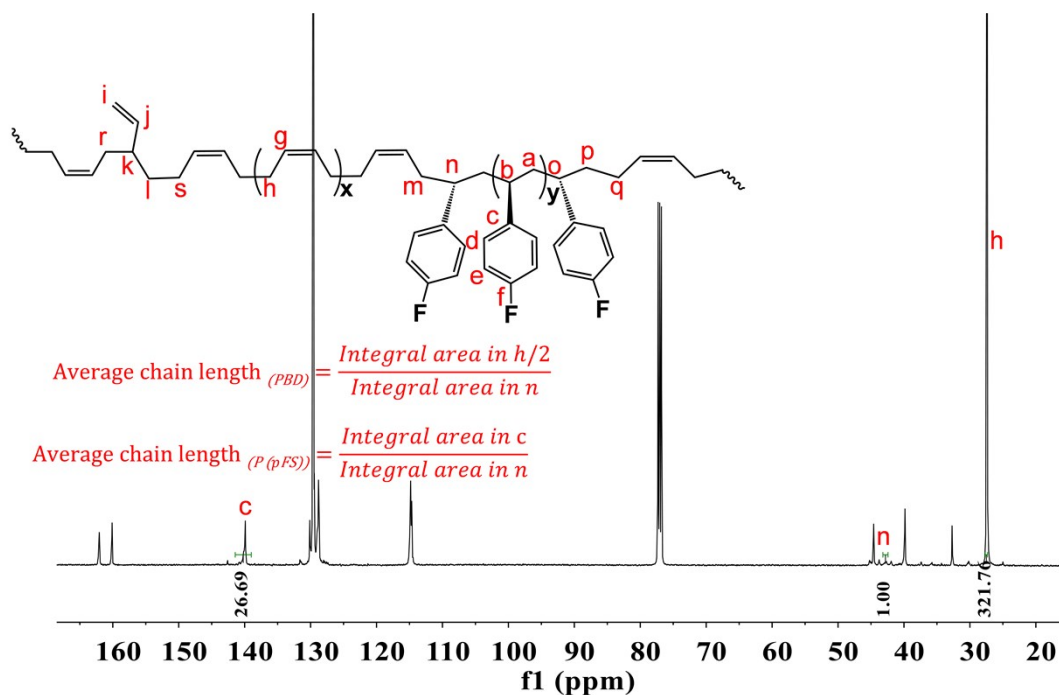
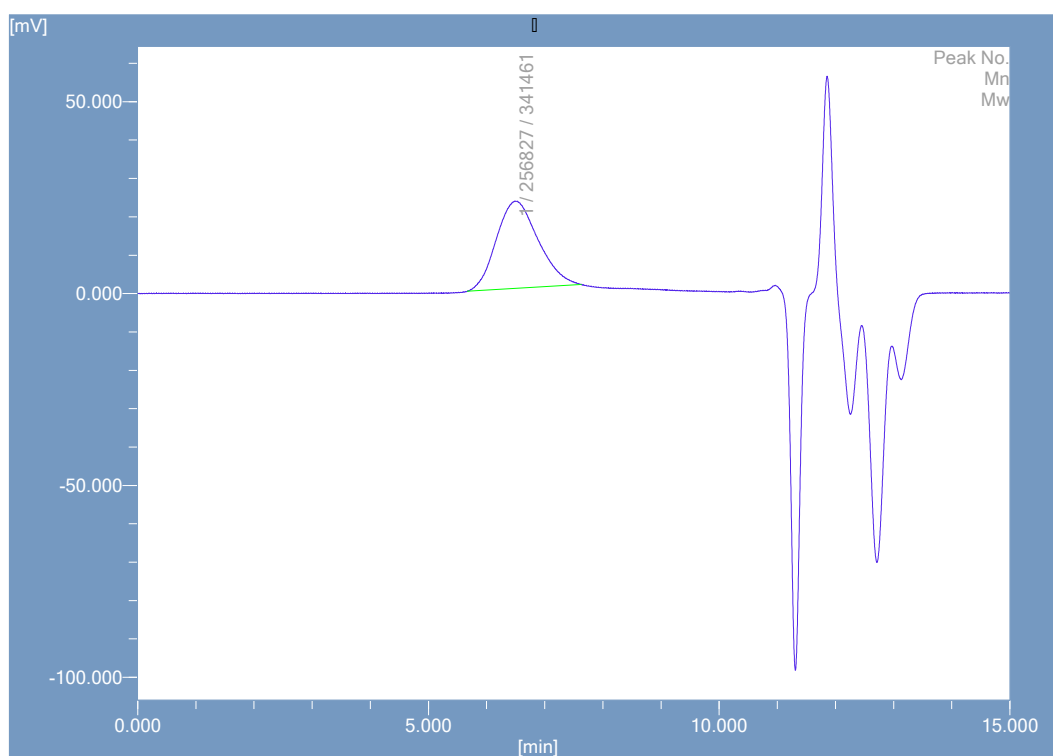


Figure S21. Quantitative ^{13}C NMR spectrum of multi-block poly(*p*FS-BD). (125MHz, CDCl_3 , 25°C).

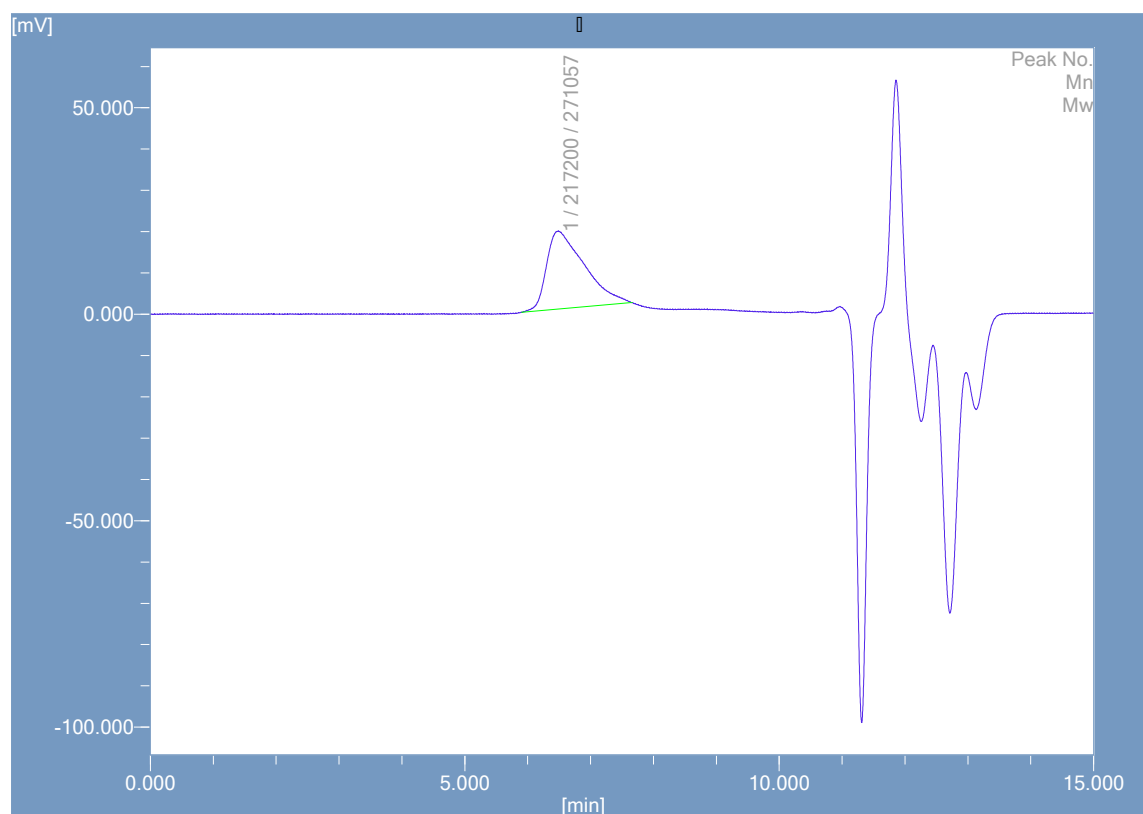


2019-10-25
: RSLT0000
: ZYH-1

— : ChromatogramRI (-105.906 - 64.378 [mV])

-RI- MN: 256827 Mw: 341461 Mz: 444169 Mw/Mn: 1.330

Figure S22. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 3).

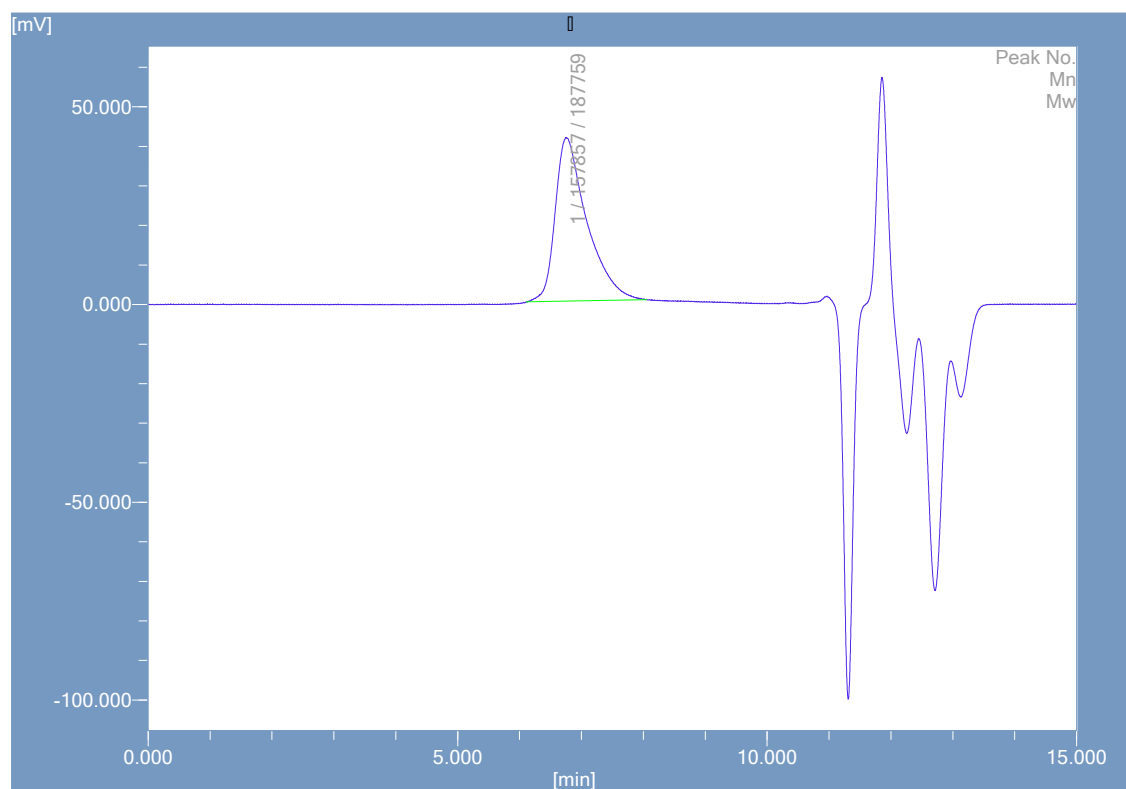


2019-10-25
: RSLT0001
: ZYH-2

— : ChromatogramRI (-106.673 - 64.497 [mV])

-RI- MN: 217200 Mw: 271057 Mz: 322956 Mw/Mn: 1.248

Figure S23. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 4).

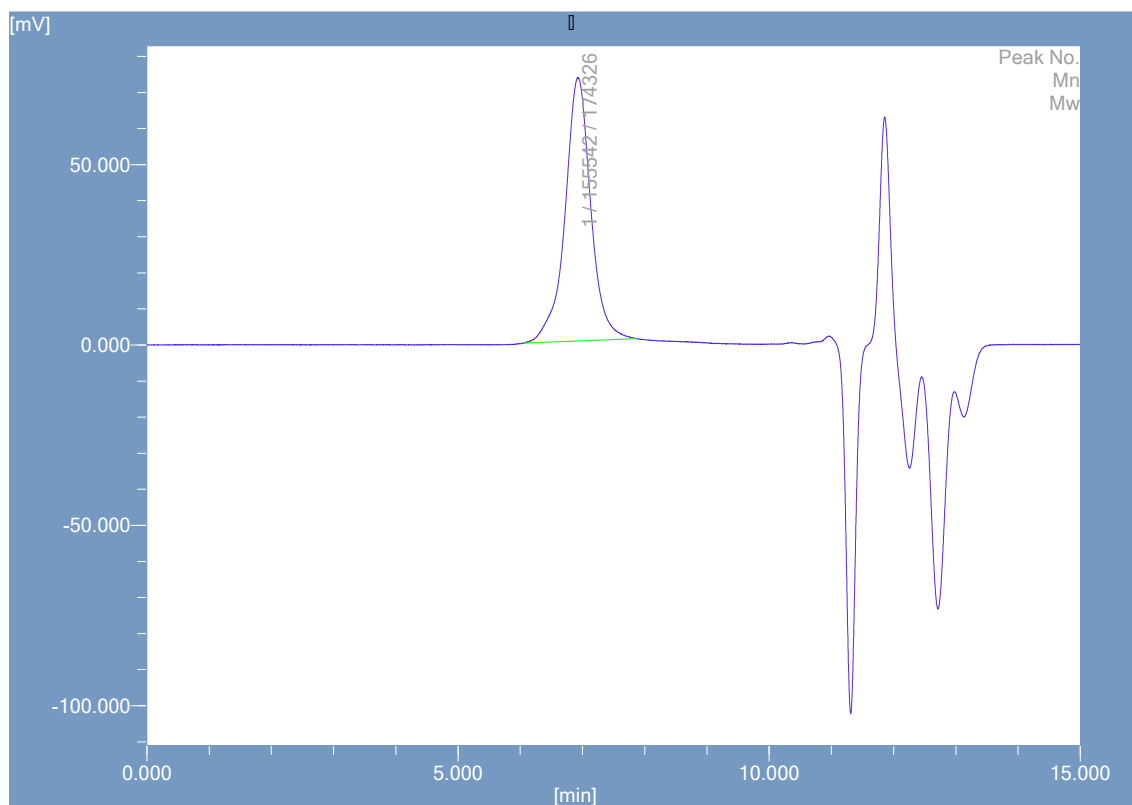


2019-10-25
 : RSLT0002
 : ZYH-3

— : ChromatogramRI (-107.673 - 65.336 [mV])

-RI- MN: 157857 Mw: 187759 Mz: 215440 Mw/Mn: 1.189

Figure S24. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 5).

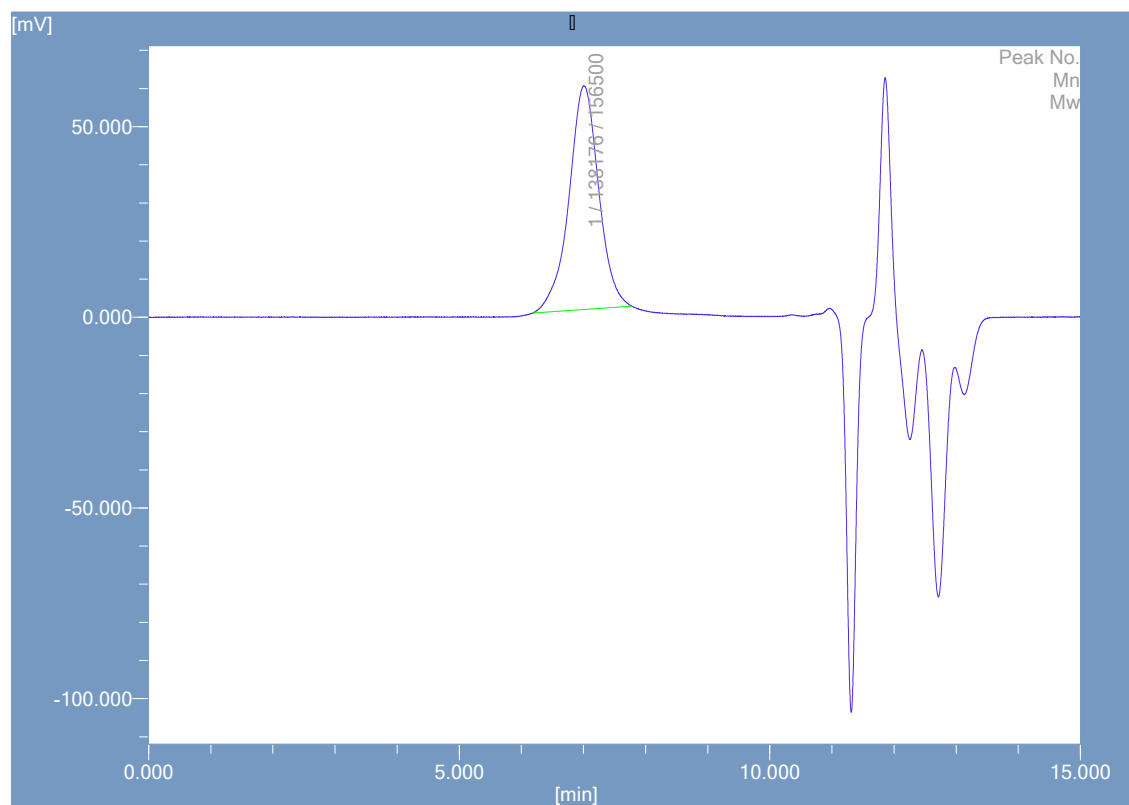


2019-10-25
: RSLT0003
: ZYH-4

— : ChromatogramRI (-110.943 - 82.911 [mV])

-RI- MN: 155542 Mw: 174326 Mz: 197582 Mw/Mn: 1.121

Figure S25. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 6).

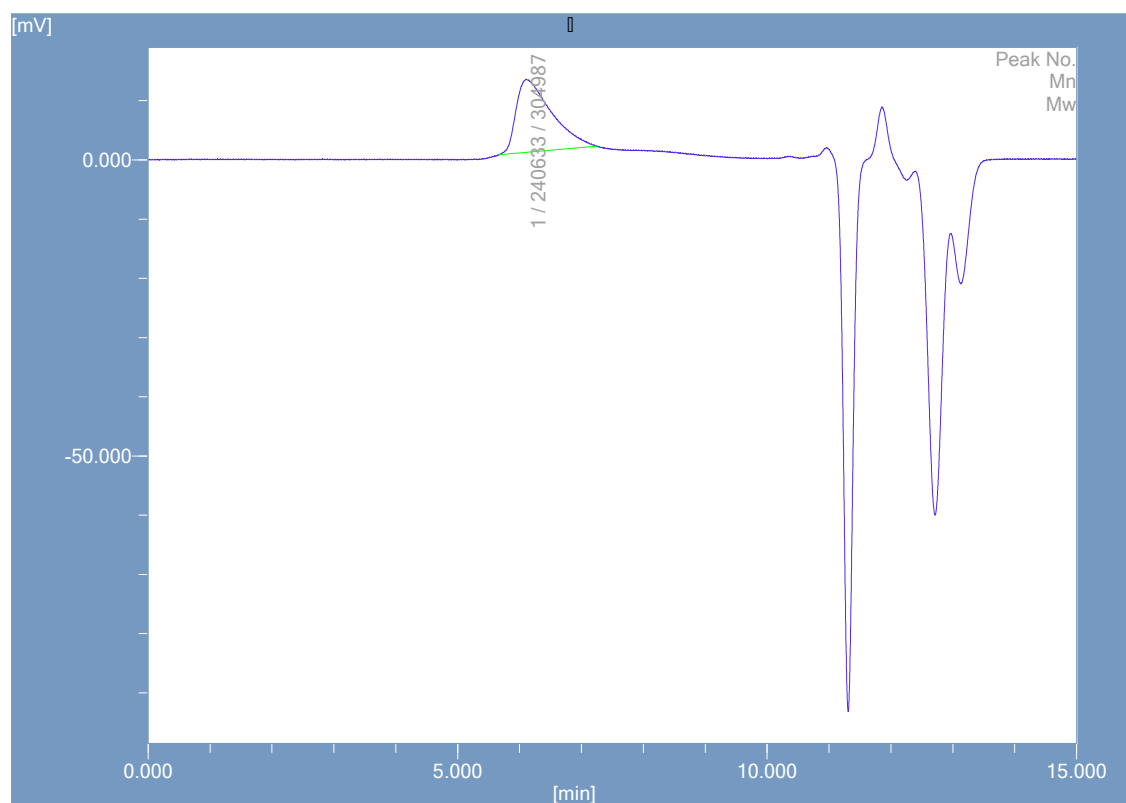


2019-10-25
: RSLT0004
: ZYH-5

— : ChromatogramRI (-111.912 - 71.188 [mV])

-RI- MN: 138176 Mw: 156500 Mz: 179279 Mw/Mn: 1.133

Figure S26. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2a** (Table 1, entry 7).

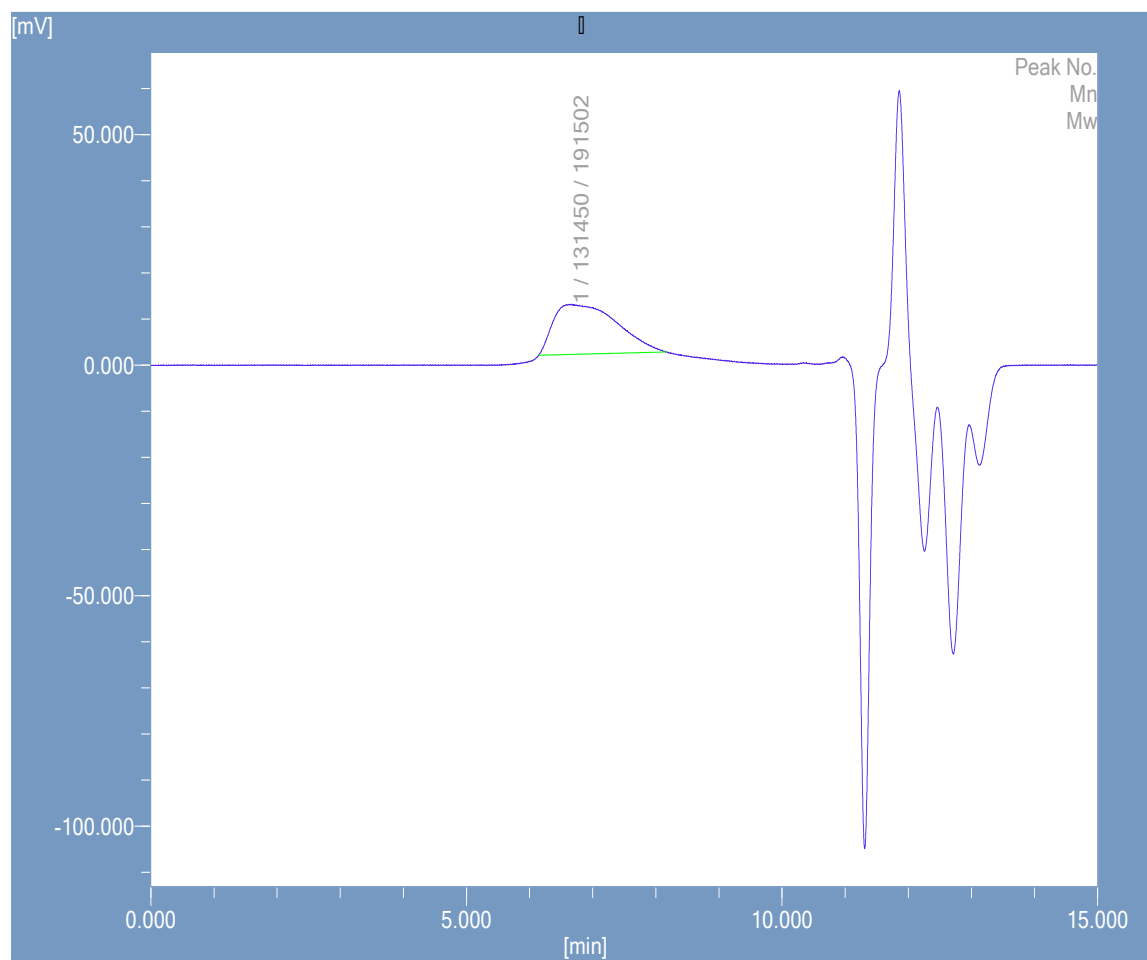


2019-11-01
 : RSLT0034
 : ZYH-3

— : ChromatogramRI (-98.494 - 18.974 [mV])

-RI- MN: 240633 Mw: 304987 Mz: 364864 Mw/Mn: 1.267

Figure S27. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 8).

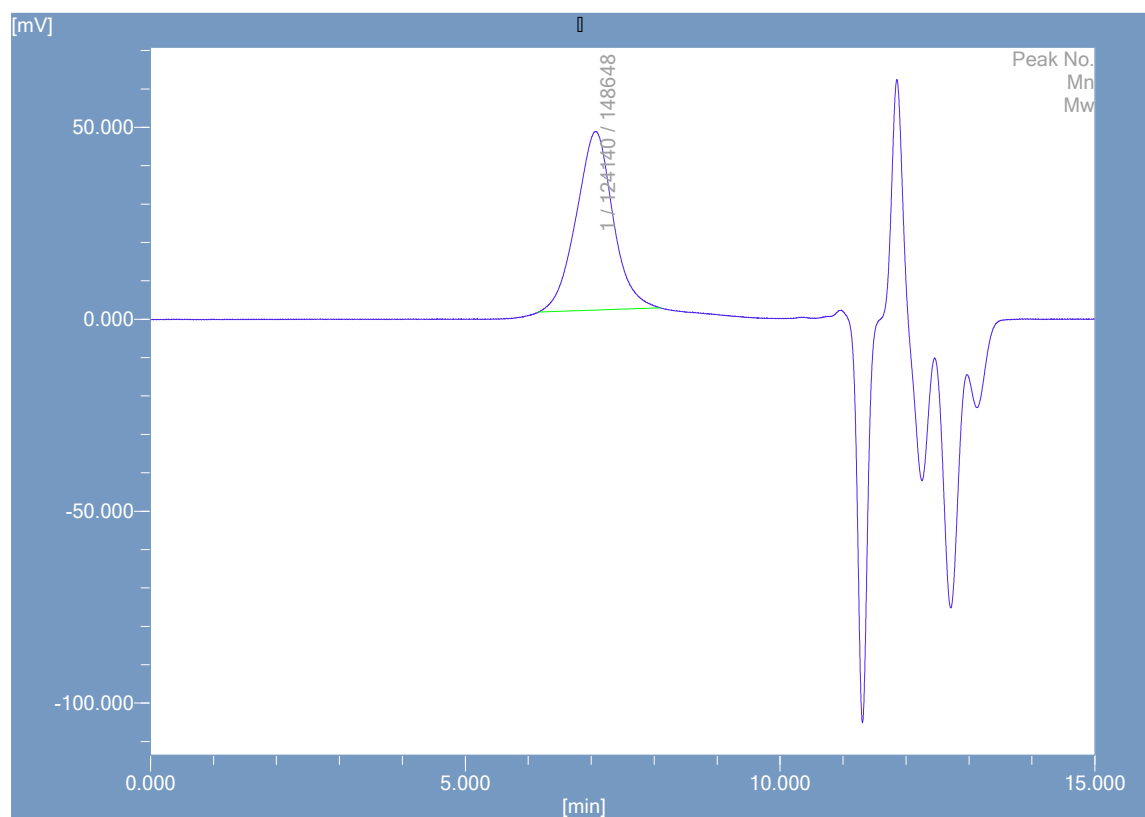


2019-10-25
 : RSLT0006
 : ZYH-7

— : ChromatogramRI (-113.052 - 67.763 [mV])

-RI- MN: 131450 Mw: 191502 Mz: 255588 Mw/Mn: 1.457

Figure S28. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 9).

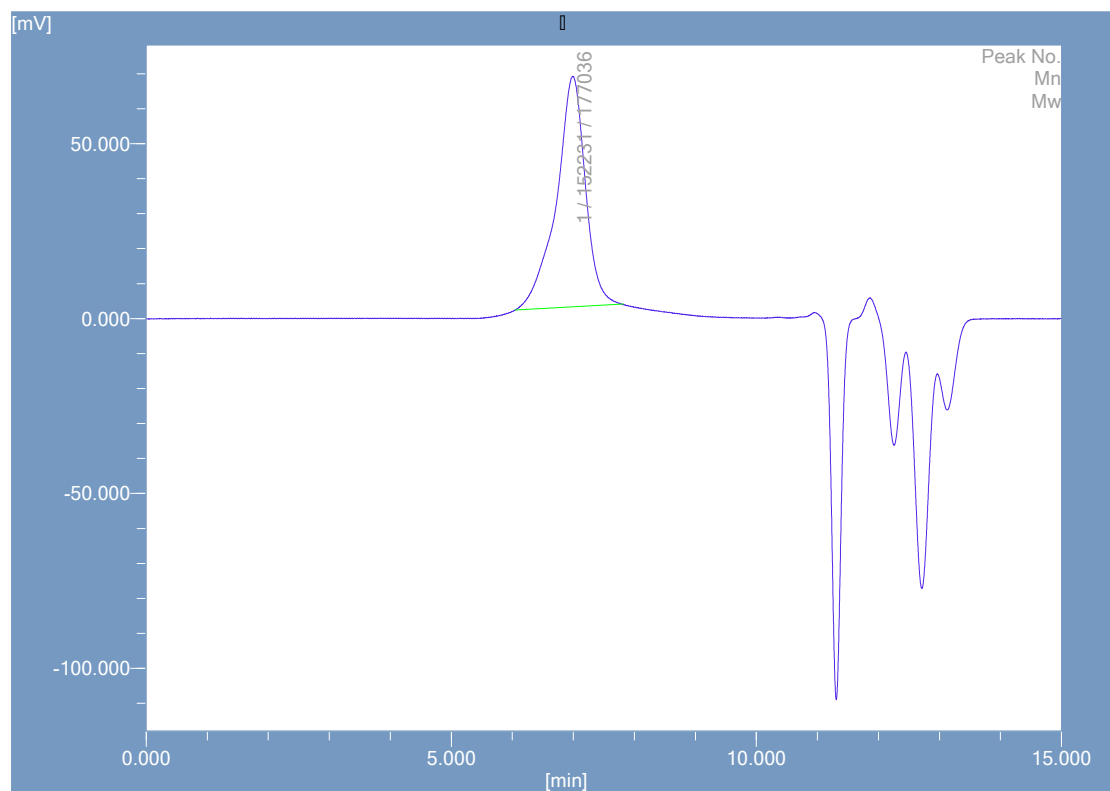


2019-10-25
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 : ZYH-8

— : ChromatogramRI (-113.519 - 70.816 [mV])

-RI- MN: 124140 Mw: 148648 Mz: 178351 Mw/Mn: 1.197

Figure S29. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 10).

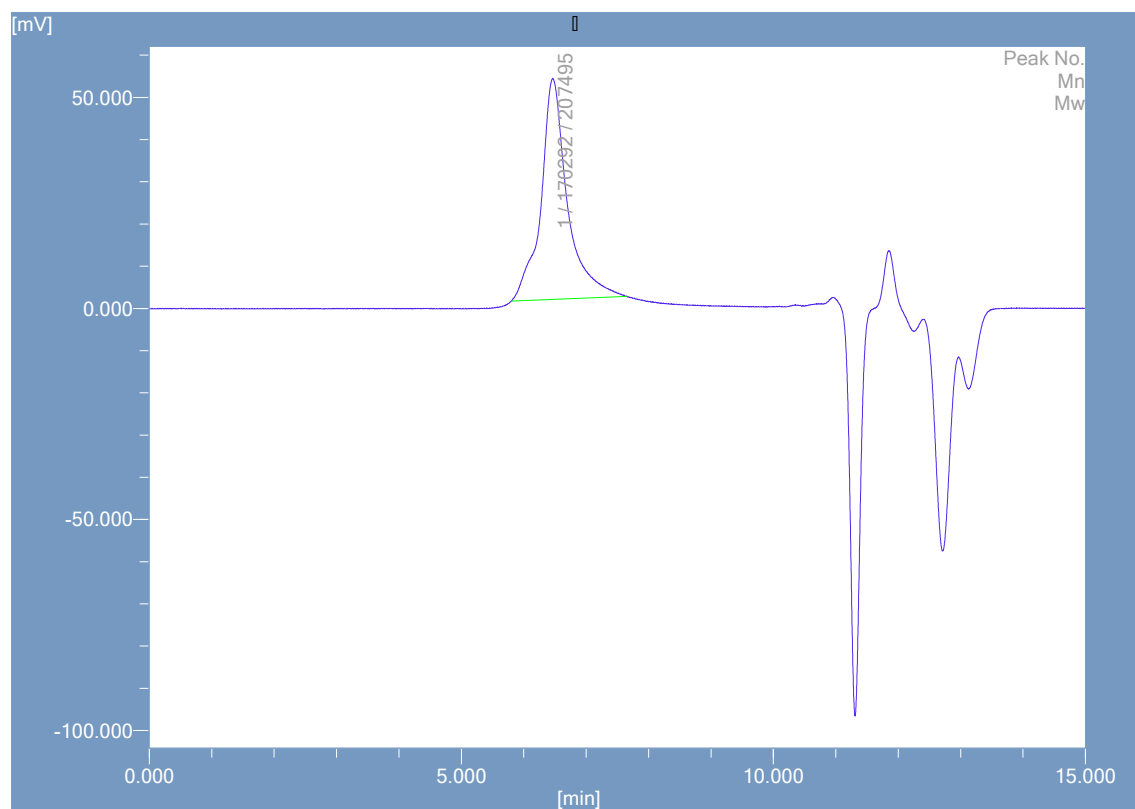


2019-10-25
: RSLT0008
: ZYH-9

— : ChromatogramRI (-117.882 - 78.186 [mV])

-RI- MN: 152231 Mw: 177036 Mz: 212152 Mw/Mn: 1.163

Figure S30. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 11).

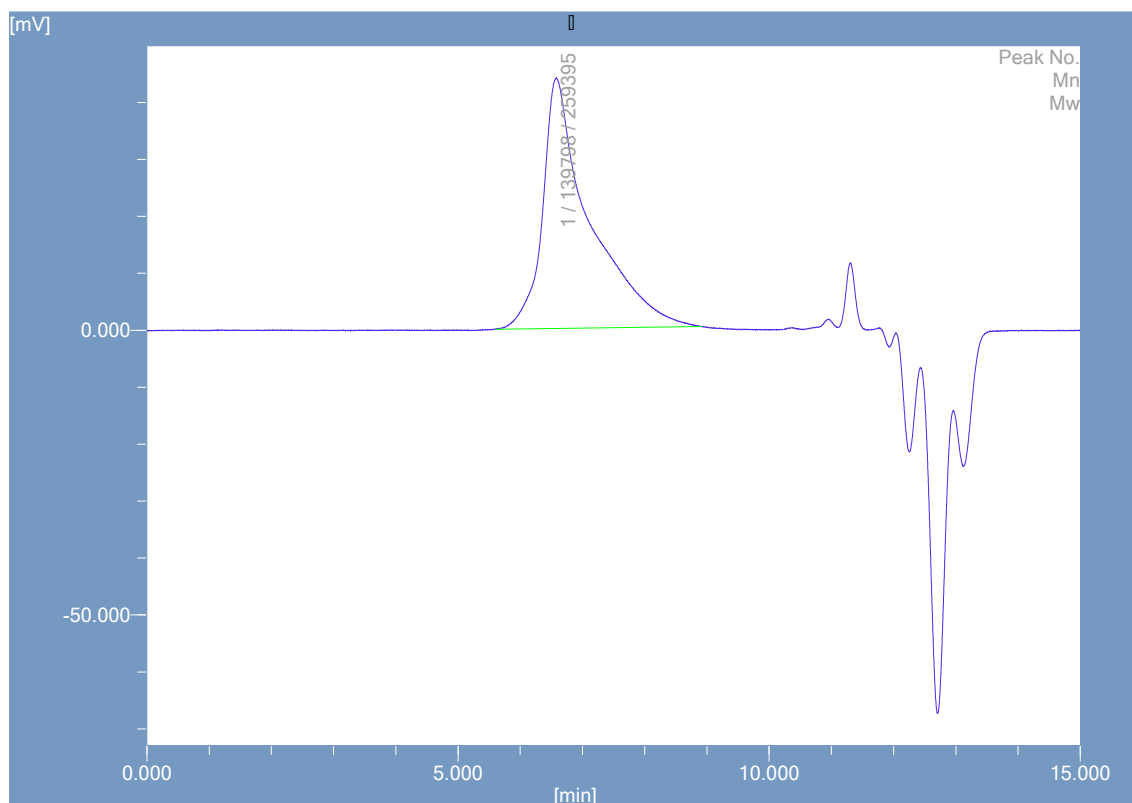


2019-11-08
: RSLT0014
: ZYH-1

— : ChromatogramRI (-104.124 - 62.057 [mV])

-RI- MN: 170292 Mw: 207495 Mz: 246585 Mw/Mn: 1.218

Figure S31. GPC curve of poly(*p*-fluorostyrene-butadiene) obtained by complex **2b** (Table 1, entry 12).



2020-05-29
: RSLT0017
: zyh-1

—: ChromatogramRI (-72.876 - 49.935 [mV])

-RI- MN: 139798 Mw: 259395 Mz: 385532 Mw/Mn: 1.855

Figure S32. GPC curve of multi-block poly(*p*-fluorostyrene-butadiene) obtained by complex **2a**.

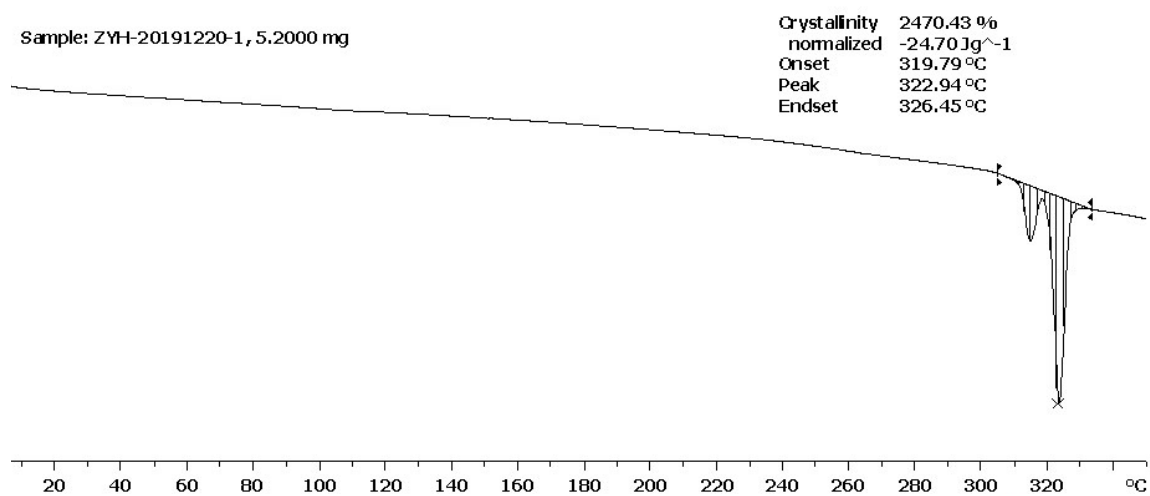


Figure S33. DSC curve of poly(*p*-fluorostyrene) obtained by complex **2a** at 20°C (Table 2, entry 1).

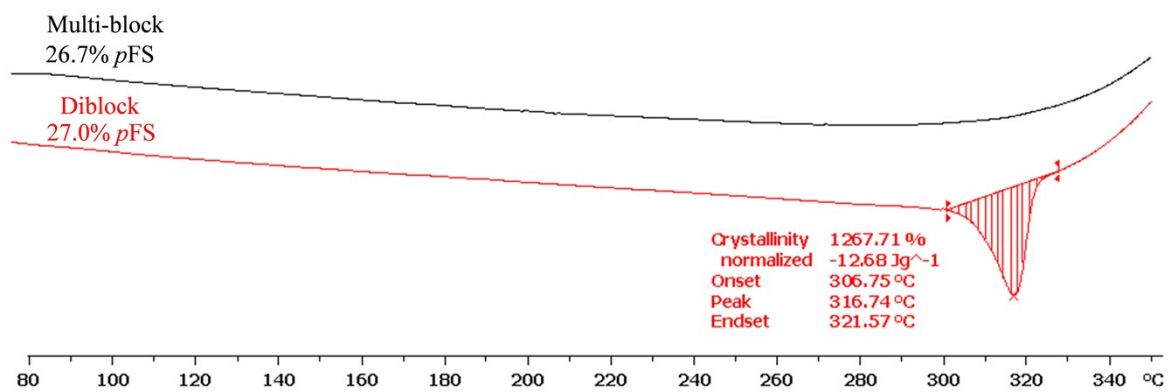


Figure S34. DSC curves of multi-block poly(*p*FS-BD)(up) and diblock poly(*p*FS-BD)(down) obtained by complex **2a**.