

Supplementary information for

Development of highly gas-permeable polymers by metathesis
copolymerization of 1-(*p*-trimethylsilyl)phenyl-1-propyne with *tert*-
butyl and silyl group-containing diphenylacetylenes

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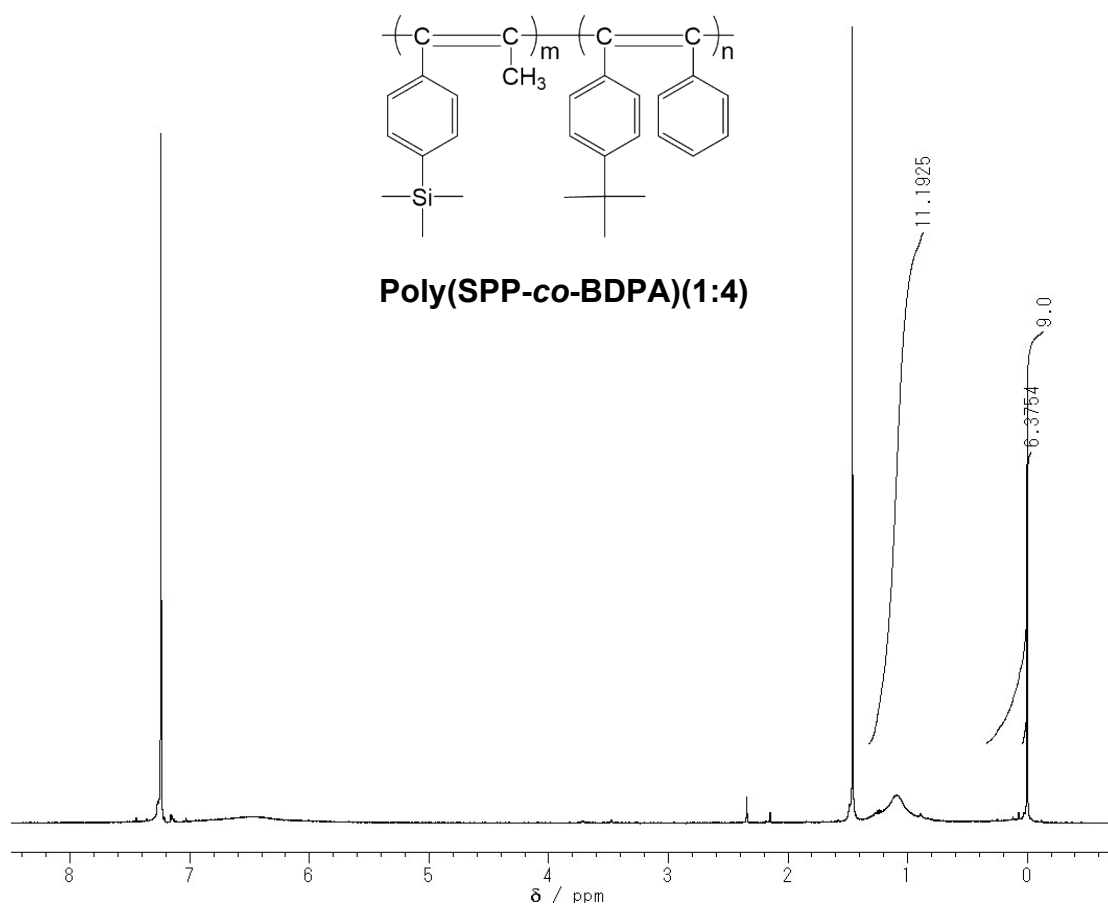


Figure S1. ¹H-NMR spectrum of **Poly(SPP-co-BDPA)(1:4)**.

Integration of ¹H of methyl groups

$$3m + 9n = 11.1925$$

Integration of ¹H of silyl groups

$$9m = 9.0 - 6.3754$$

Composition ratio of **Poly(SPP-co-BDPA)(1:4)**:

$$m:n \approx 1:3.93$$

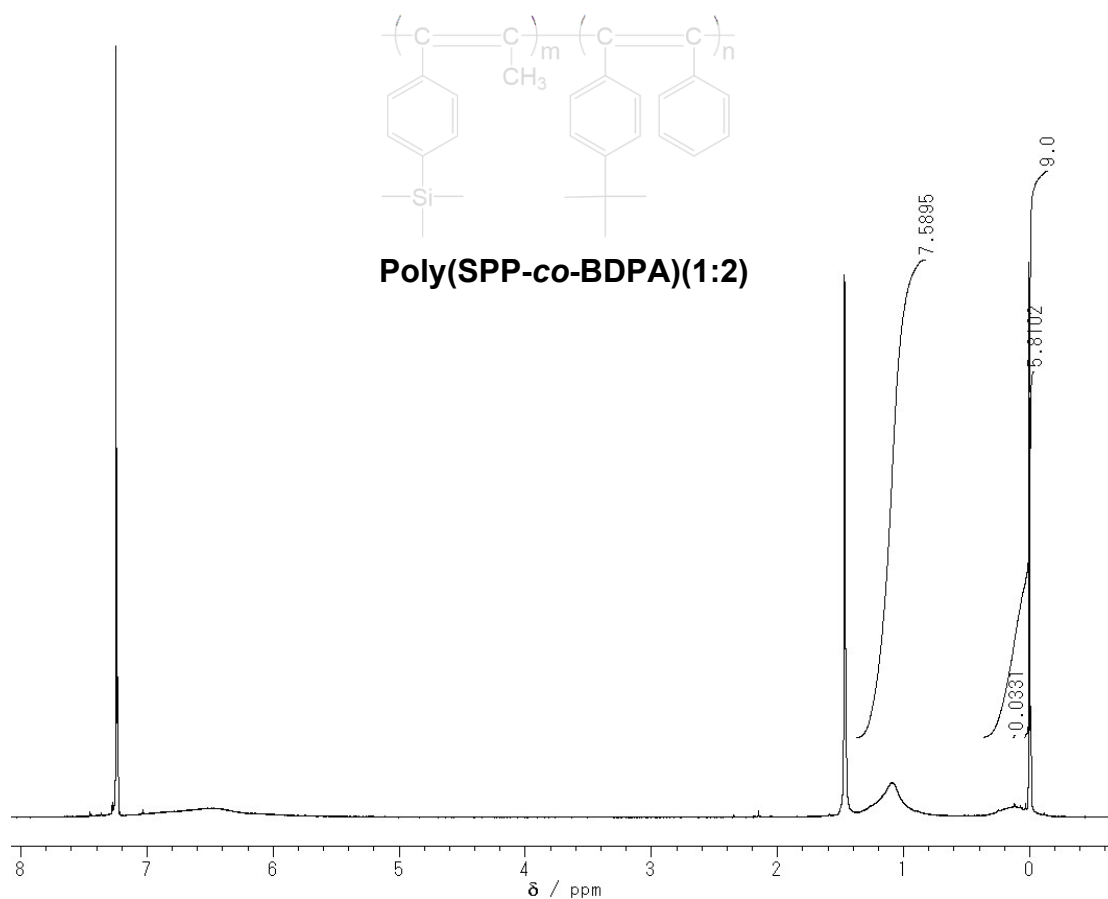


Figure S2. ¹H-NMR spectrum of **Poly(SPP-co-BDPA)(1:2)**.

Integration of ¹H of methyl groups

$$3m + 9n = 7.5895$$

Integration of ¹H of silyl groups

$$9m = 9.0 - 5.8102 - 0.0331$$

Composition ratio of **Poly(SPP-co-BDPA)(1:2)**:

$$m:n \approx 1:2.07$$

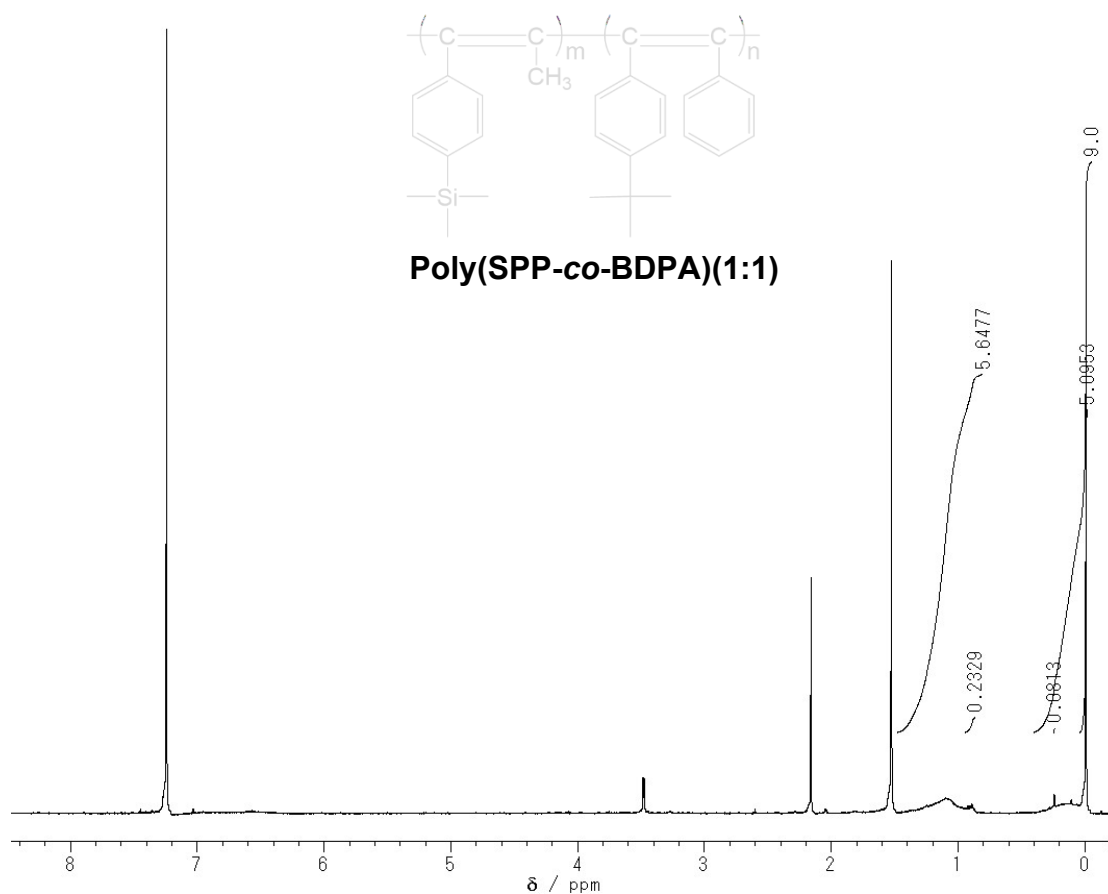


Figure S3. ¹H-NMR spectrum of **Poly(SPP-co-BDPA)(1:1)**.

Integration of ¹H of methyl groups

$$3m + 9n = 5.6477 - 0.2329$$

Integration of ¹H of silyl groups

$$9m = 9.0 - 5.0953 - 0.0813$$

Composition ratio of **Poly(SPP-co-BDPA)(1:1)**:

$$m:n \approx 1:1.08$$

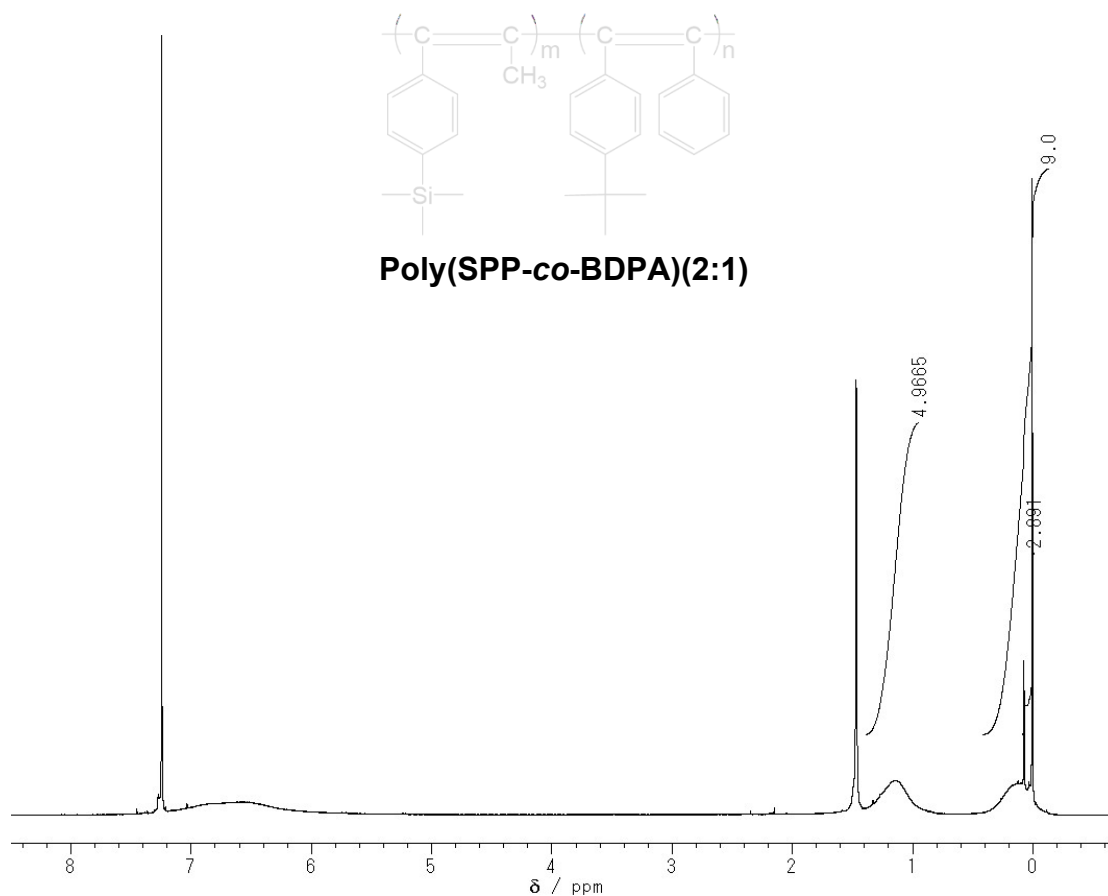


Figure S4. ¹H-NMR spectrum of **Poly(SPP-co-BDPA)(2:1)**.

Integration of ¹H of methyl groups

$$3m + 9n = 4.9665$$

Integration of ¹H of silyl groups

$$9m = 9.0 - 2.891$$

Composition ratio of **Poly(SPP-co-BDPA)(2:1)**:

$$m:n \approx 2.08:1$$

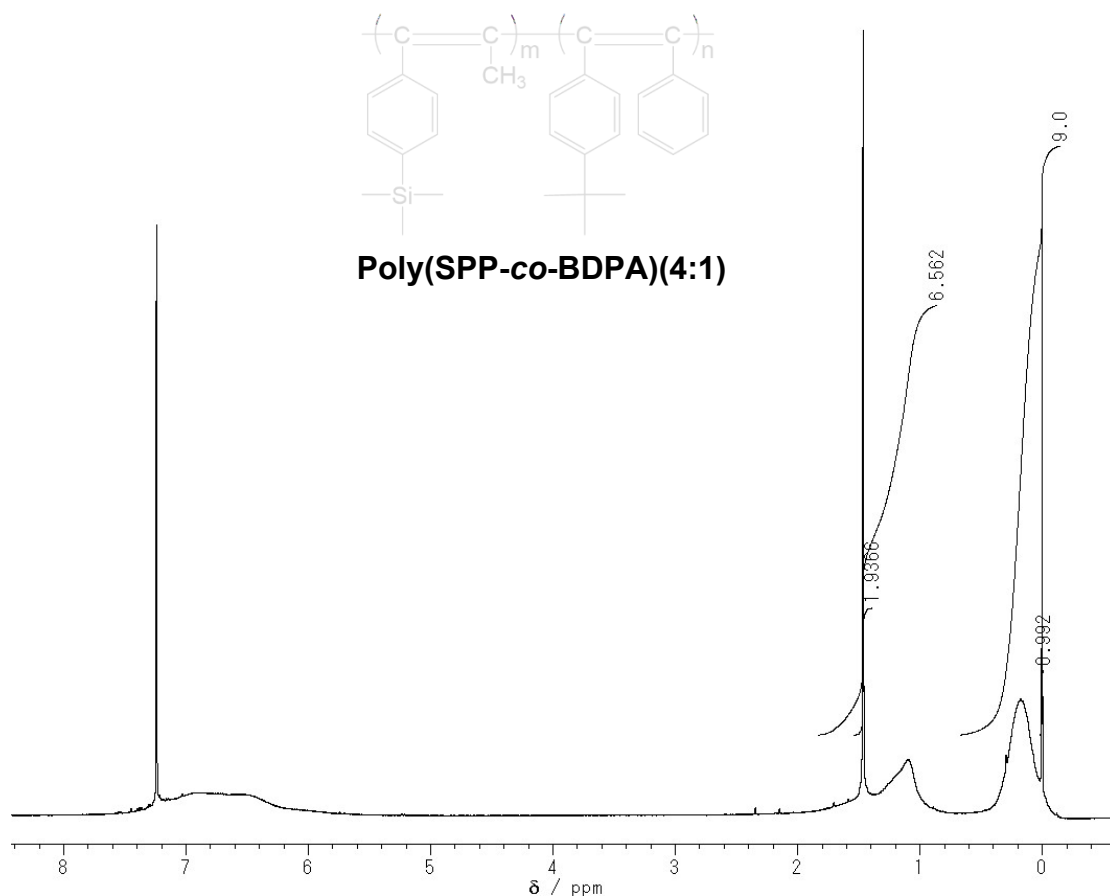


Figure S5. ¹H-NMR spectrum of **Poly(SPP-co-BDPA)(4:1)**.

Integration of ¹H of methyl groups

$$3m + 9n = 6.562 - 1.9366$$

Integration of ¹H of silyl groups

$$9m = 9.0 - 0.992$$

Composition ratio of **Poly(SPP-co-BDPA)(4:1)**:

$$m:n \approx 4.09:1$$

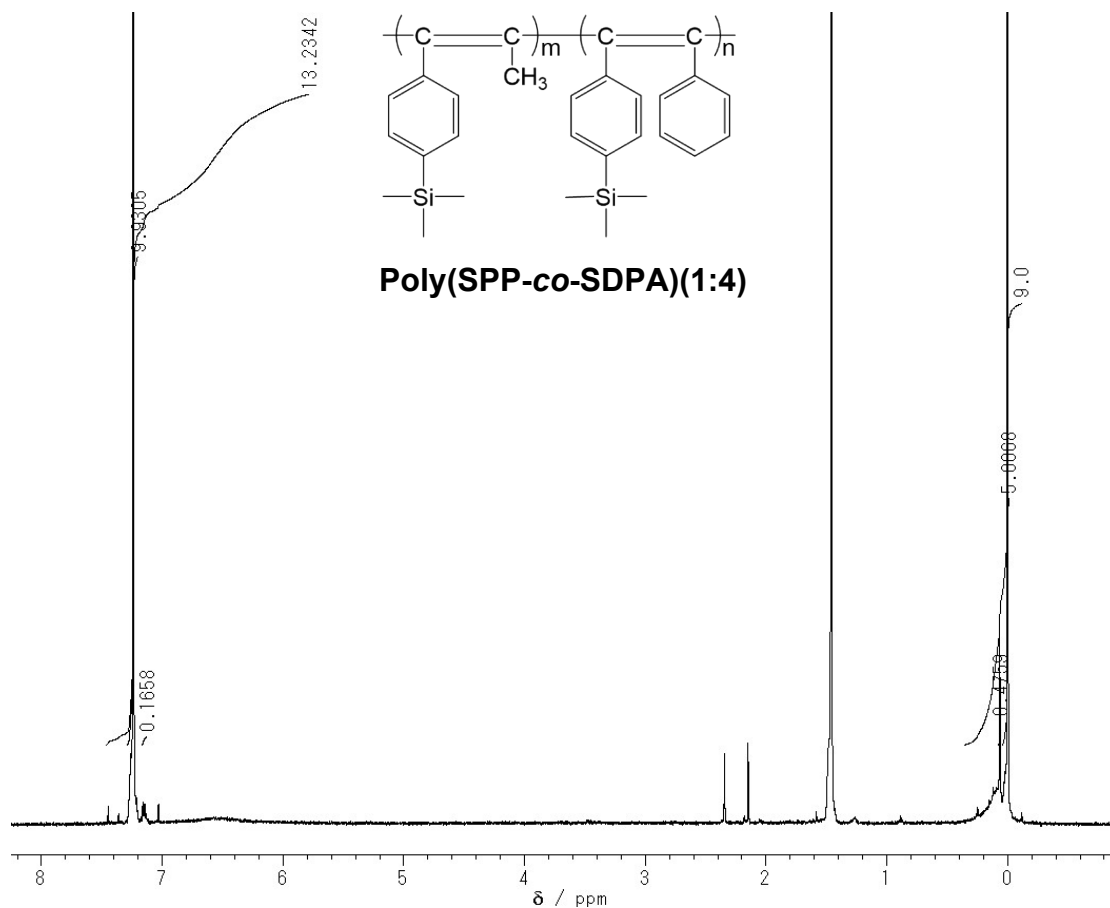


Figure S6. ¹H-NMR spectrum of **Poly(SPP-co-SDPA)(1:4)**.

Integration of ¹H of phenyl groups

$$4m + 9n = 13.2342 - 9.9305 - 0.1658$$

Integration of ¹H of silyl groups

$$9m + 9n = 9.0 - 5.0068 - 0.4759$$

Composition ratio of **Poly(SPP-co-SDPA)(1:4)**:

$$m:n \approx 1:4.15$$

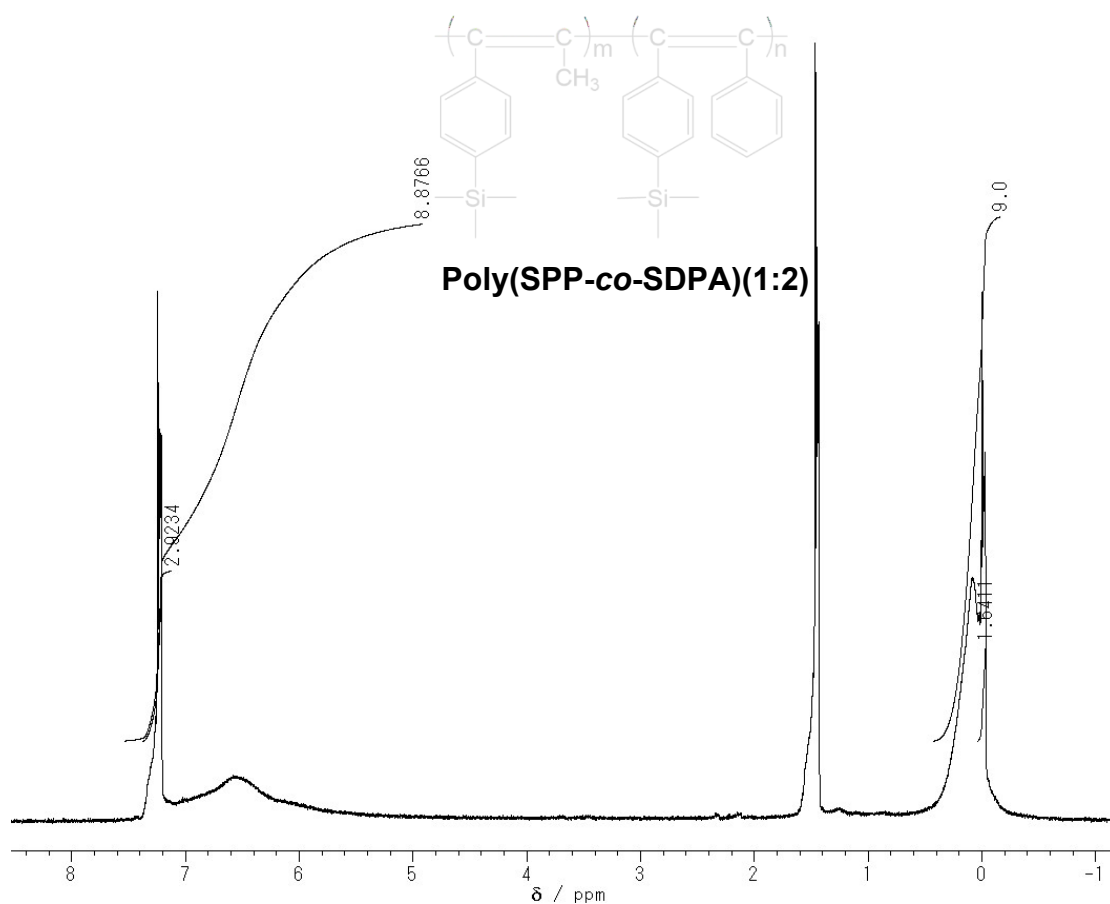


Figure S7. ¹H-NMR spectrum of **Poly(SPP-co-SDPA)(1:2)**.

Integration of ¹H of phenyl groups

$$4m + 9n = 8.8766 - 2.9234$$

Integration of ¹H of silyl groups

$$9m + 9n = 9.0 - 1.6411$$

Composition ratio of **Poly(SPP-co-SDPA)(1:2)**:

$$m:n \approx 1:1.91$$

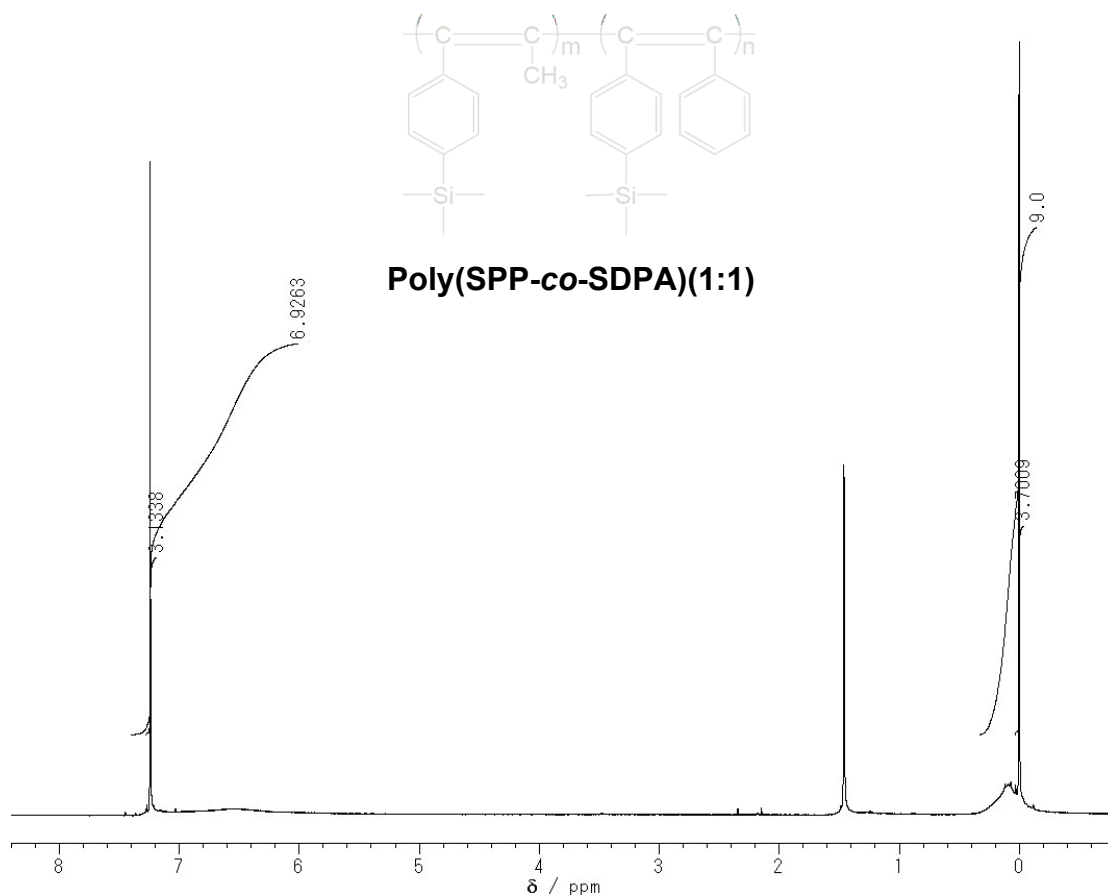


Figure S8. ¹H-NMR spectrum of **Poly(SPP-co-SDPA)(1:1)**.

Integration of ¹H of phenyl groups

$$4m + 9n = 6.9263 - 3.1338$$

Integration of ¹H of silyl groups

$$9m + 9n = 9.0 - 3.7009$$

Composition ratio of **Poly(SPP-co-SDPA)(1:1)**:

$$m:n \approx 1:0.95$$

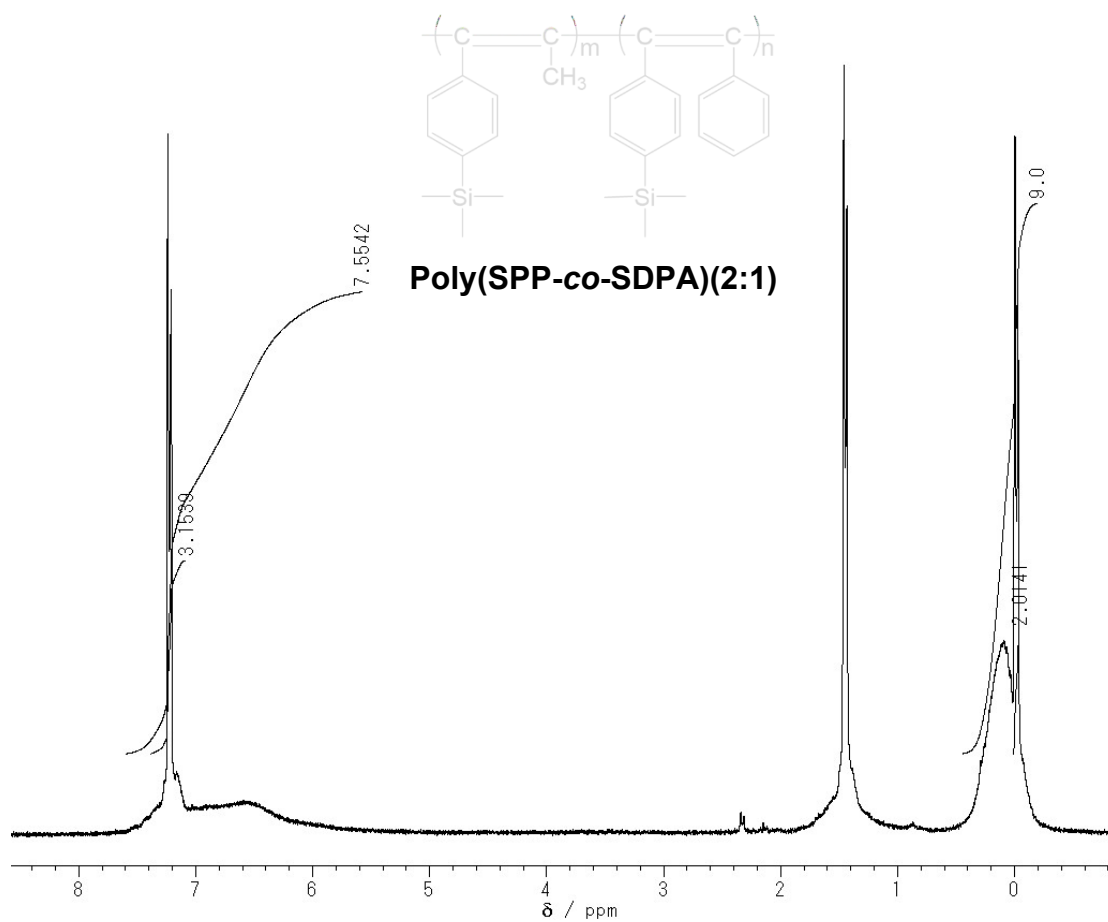


Figure S9. ¹H-NMR spectrum of **Poly(SPP-co-SDPA)(2:1)**.

Integration of ¹H of phenyl groups

$$4m + 9n = 7.5542 - 3.1539$$

Integration of ¹H of silyl groups

$$9m + 9n = 9.0 - 2.0141$$

Composition ratio of **Poly(SPP-co-SDPA)(2:1)**:

$$m:n \approx 2.00:1$$

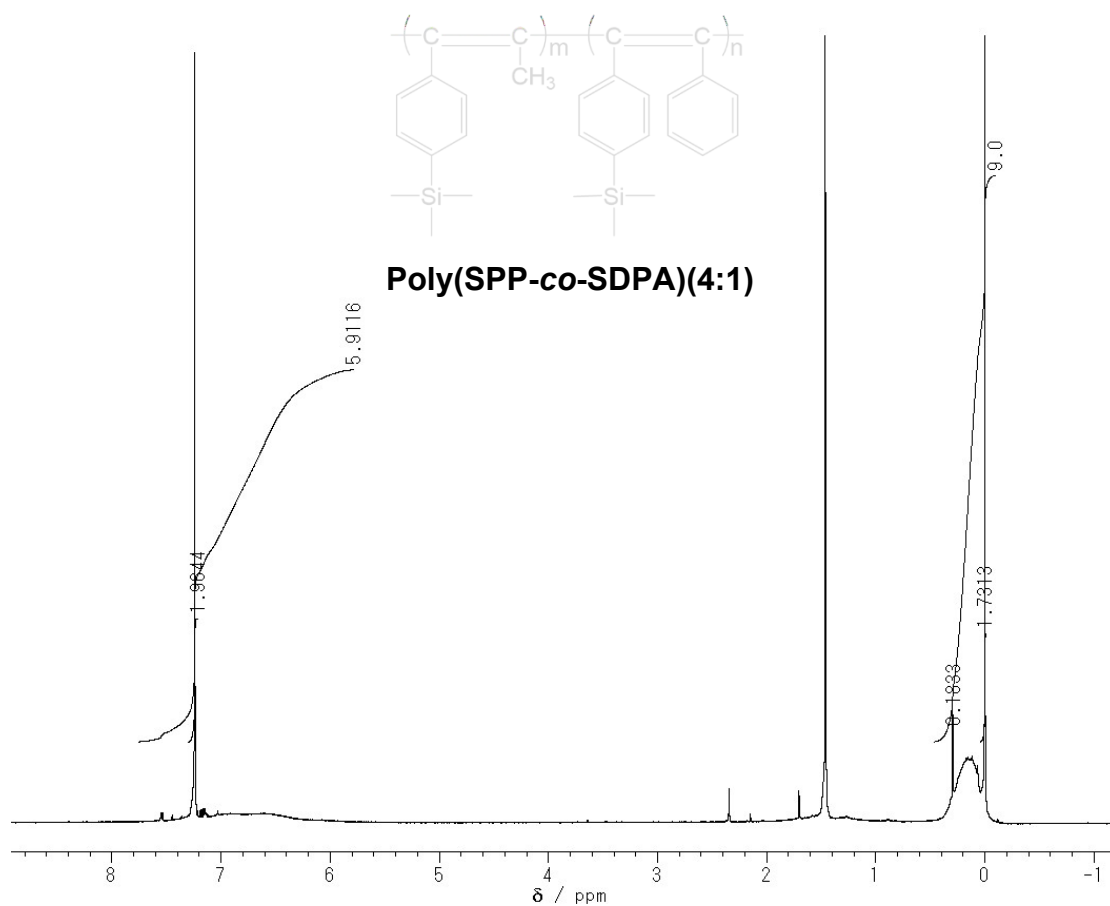


Figure S10. ¹H-NMR spectrum of **Poly(SPP-co-SDPA)(4:1)**.

Integration of ¹H of phenyl groups

$$4m + 9n = 5.9116 - 1.9644$$

Integration of ¹H of silyl groups

$$9m + 9n = 9.0 - 1.7313 - 0.1833$$

Composition ratio of **Poly(SPP-co-SDPA)(4:1)**:

$$m:n \approx 3.98:1$$

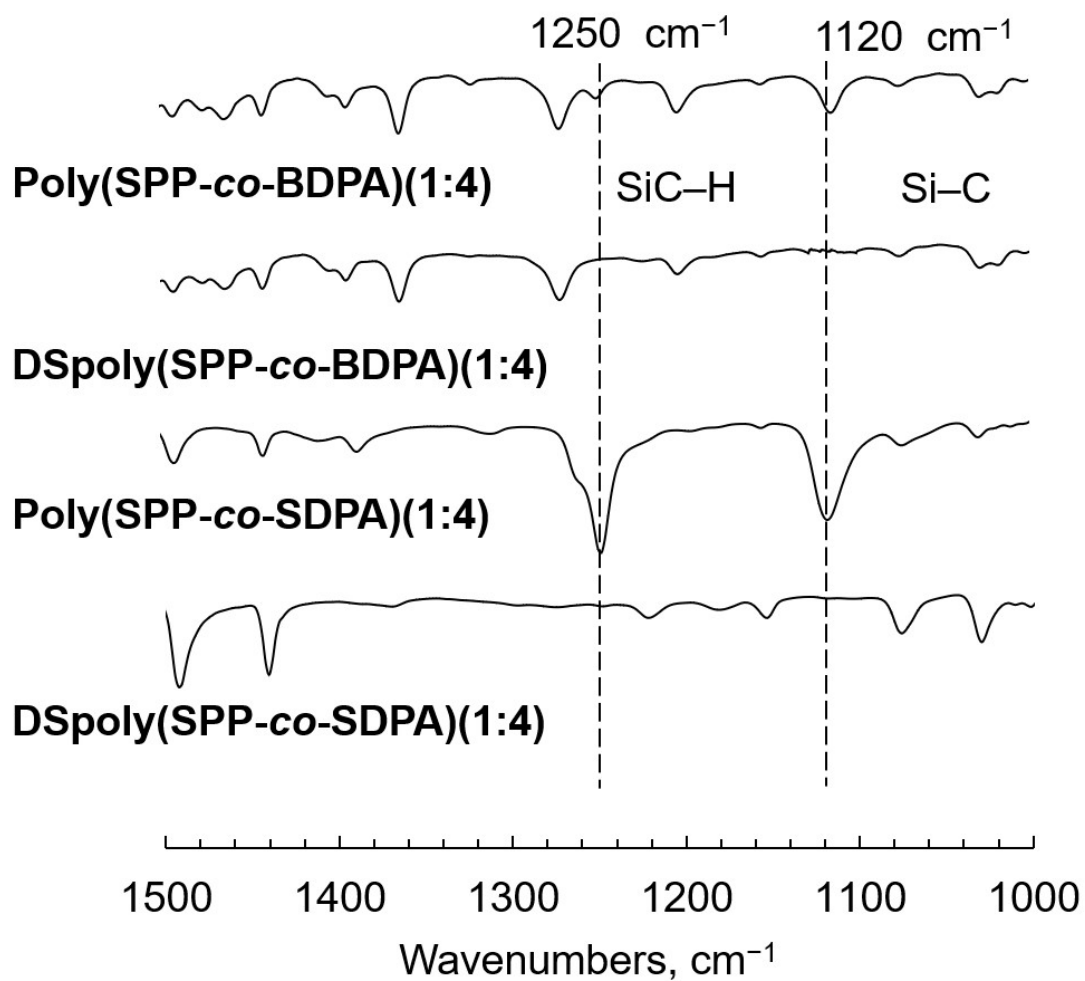


Figure S11. FT-IR spectra of **Poly(SPP-co-BDPA)(1:4)**, **Poly(SPP-co-SDPA)(1:4)**, **DSpoly(SPP-co-BDPA)(1:4)** and **DSpoly(SPP-co-SDPA)(1:4)**.

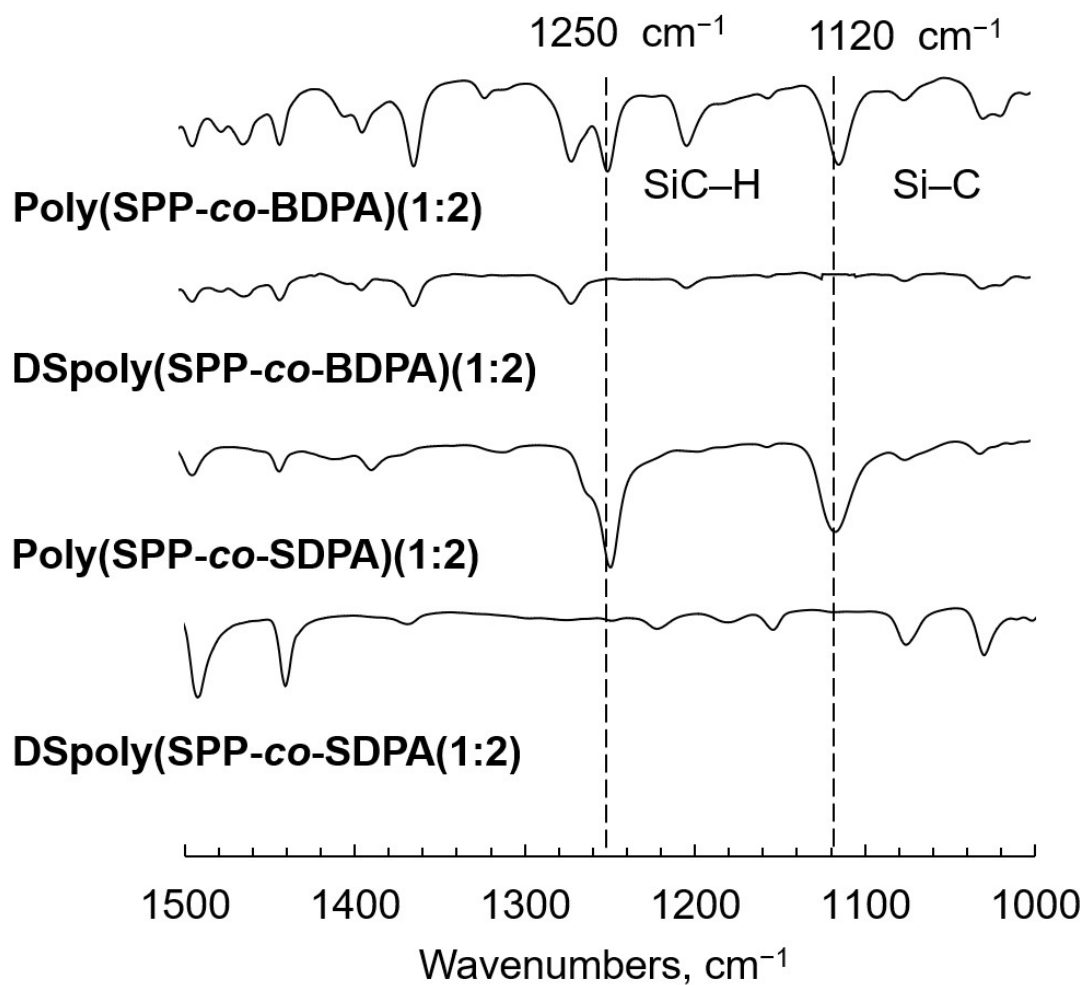


Figure S12. FT-IR spectra of **Poly(SPP-co-BDPA)(1:2)**, **Poly(SPP-co-SDPA)(1:2)**, **DSpoly(SPP-co-BDPA)(1:2)** and **DSpoly(SPP-co-SDPA)(1:2)**.

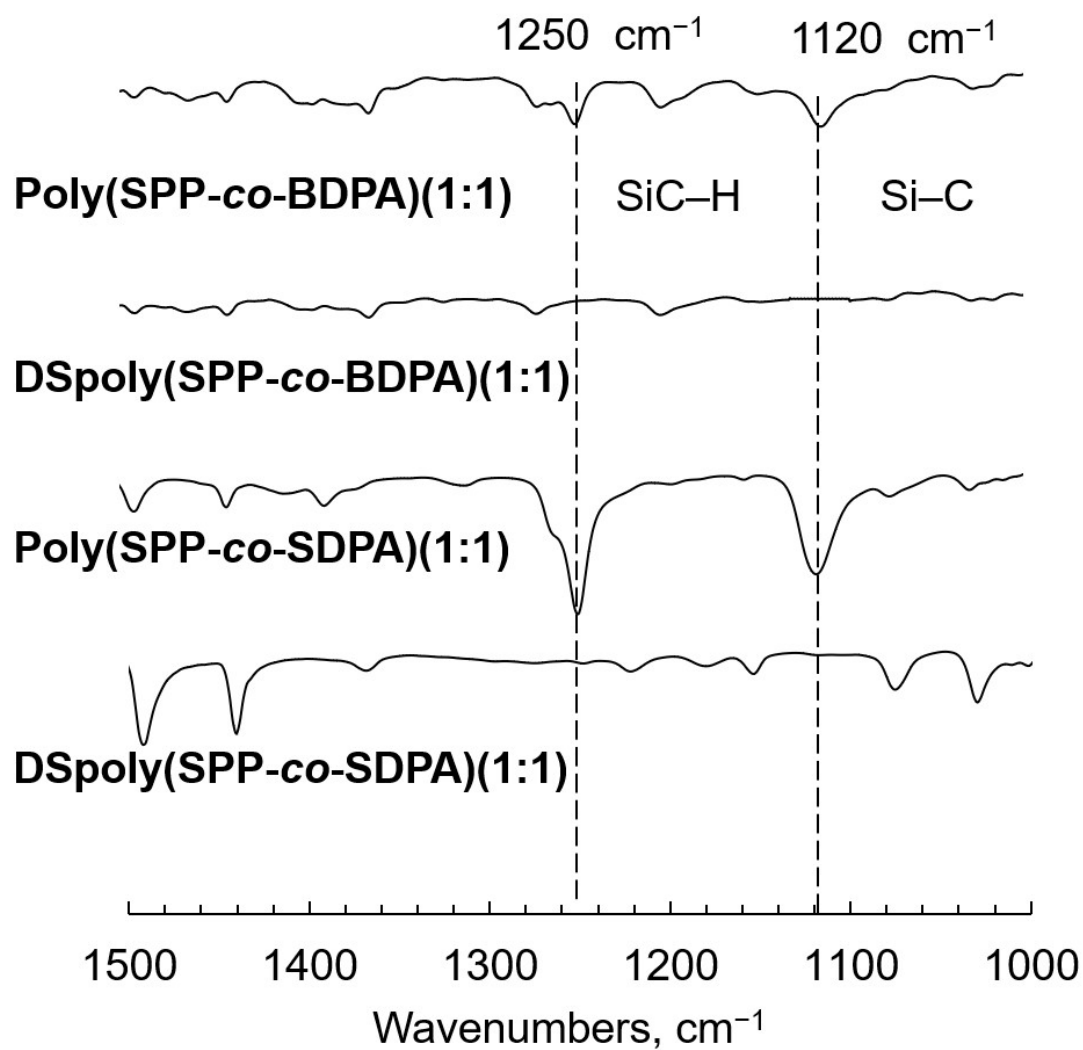


Figure S13. FT-IR spectra of **Poly(SPP-co-BDPA)(1:1)**, **Poly(SPP-co-SDPA)(1:1)**, **DSPoly(SPP-co-BDPA)(1:1)** and **DSPoly(SPP-co-SDPA)(1:1)**.

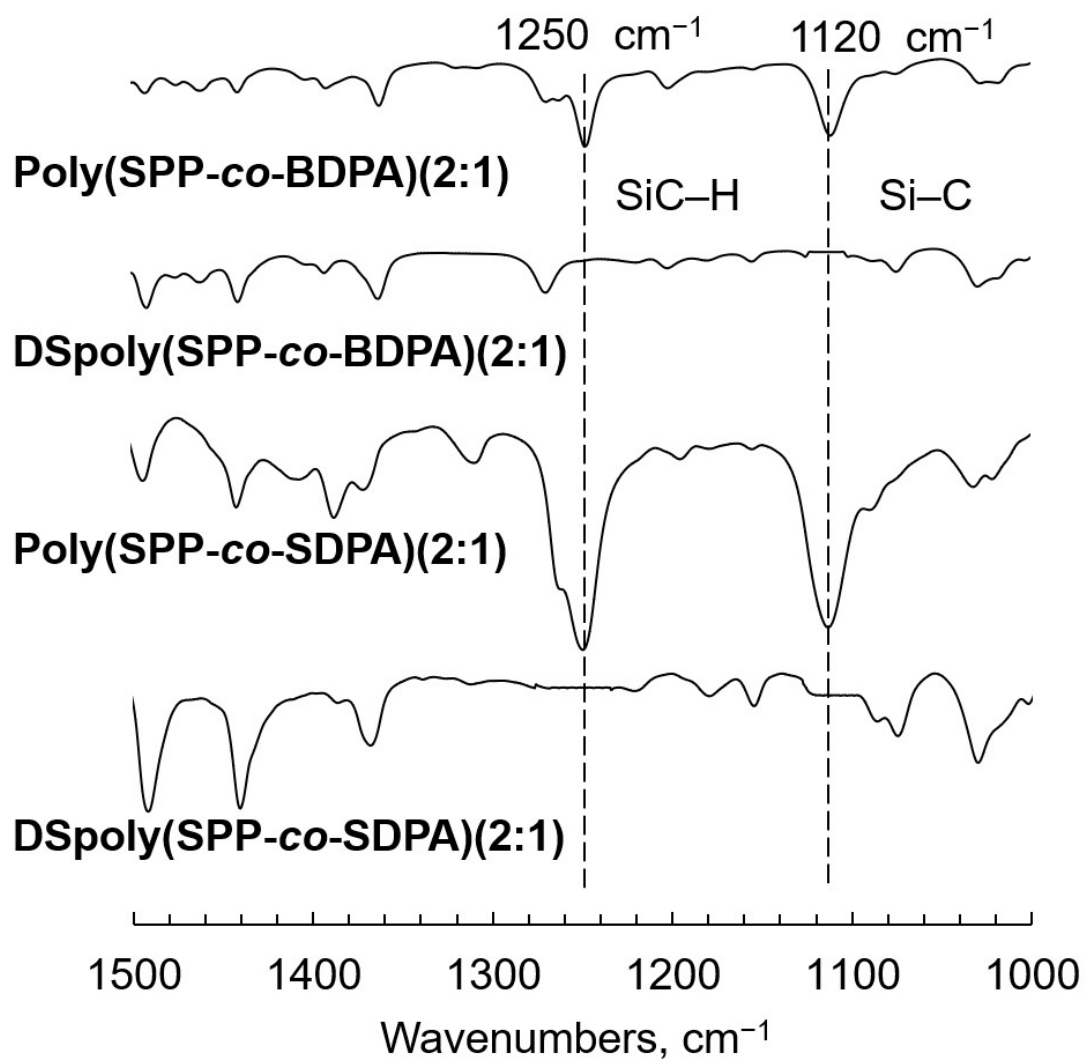


Figure S14. FT-IR spectra of **Poly(SPP-co-BDPA)(2:1)**, **Poly(SPP-co-SDPA)(2:1)**, **DSpoly(SPP-co-BDPA)(2:1)** and **DSpoly(SPP-co-SDPA)(2:1)**.

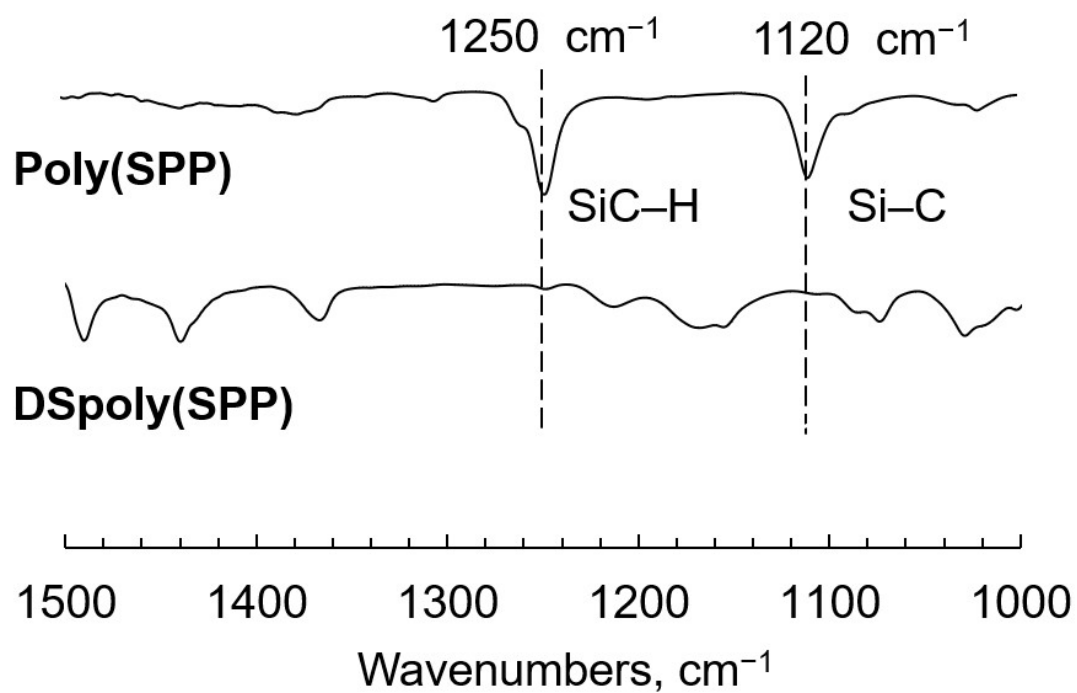


Figure S15. FT-IR spectra of **Poly(SPP)** and **DSpoly(SPP)**.

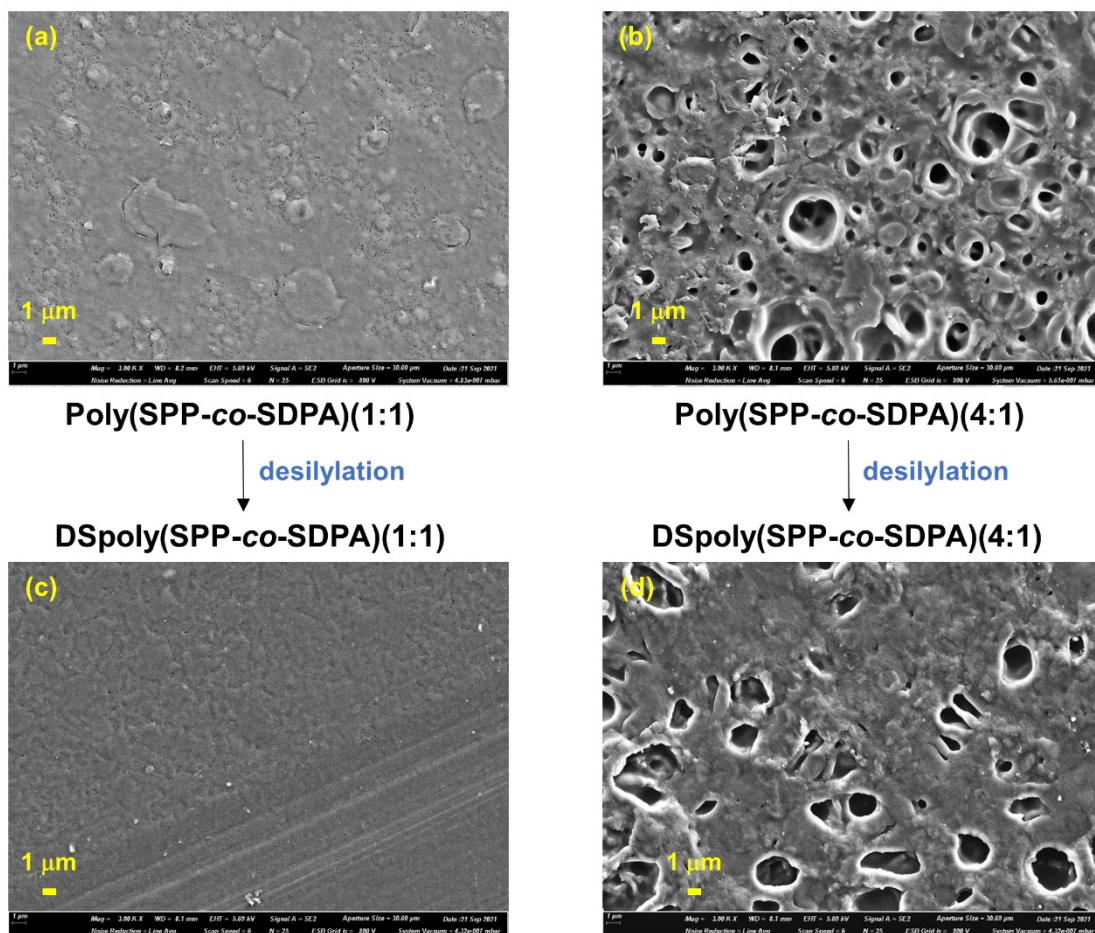


Figure S16. SEM images of membrane surfaces for (a) poly(SPP-co-SDPA)(1:1), (b) poly(SPP-co-SDPA)(4:1), (c) DSpoly(SPP-co-SDPA)(1:1), and (d) DSpoly(SPP-co-SDPA)(4:1).

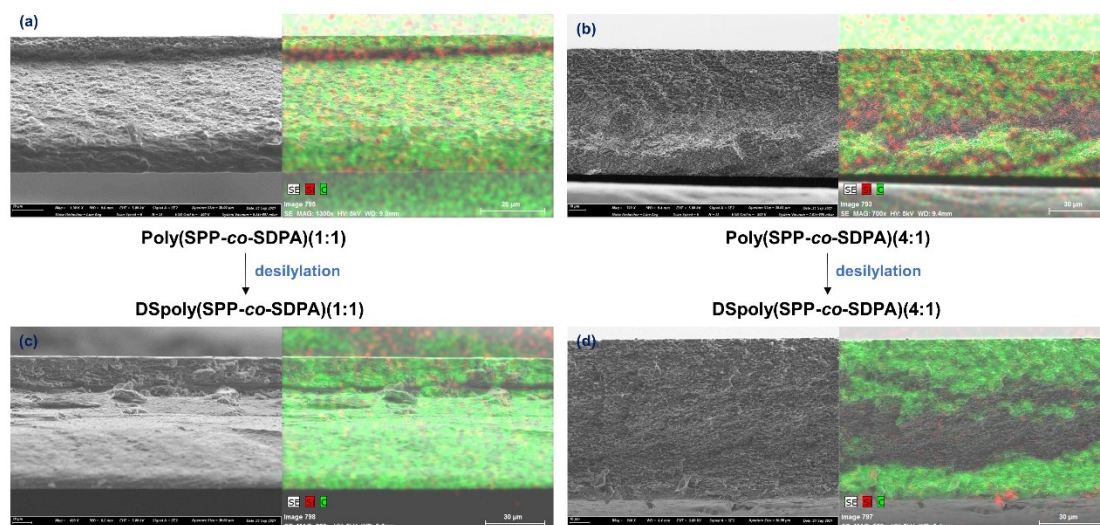


Figure S17. SEM images and signal maps of membrane cross-section for (a) poly(SPP-co-SDPA)(1:1), (b) poly(SPP-co-SDPA)(4:1), (c) DSpoly(SPP-co-SDPA)(1:1), and (d) DSpoly(SPP-co-SDPA)(4:1). The green and red regions correspond to carbon and silicon, respectively.

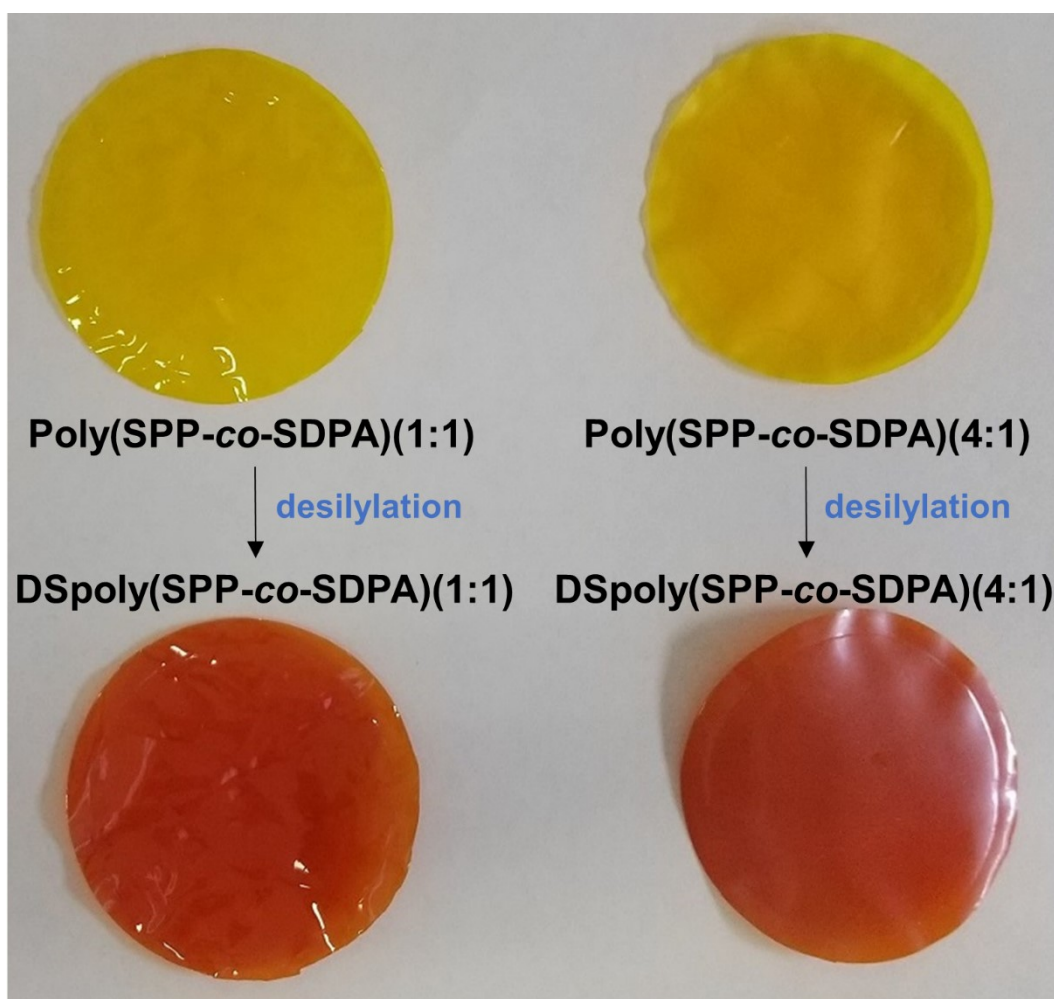


Figure S18. Photographs of poly(SPP-co-SDPA)(1:1), poly(SPP-co-SDPA)(4:1), DSpoly(SPP-co-SDPA)(1:1), and DSpoly(SPP-co-SDPA)(4:1).

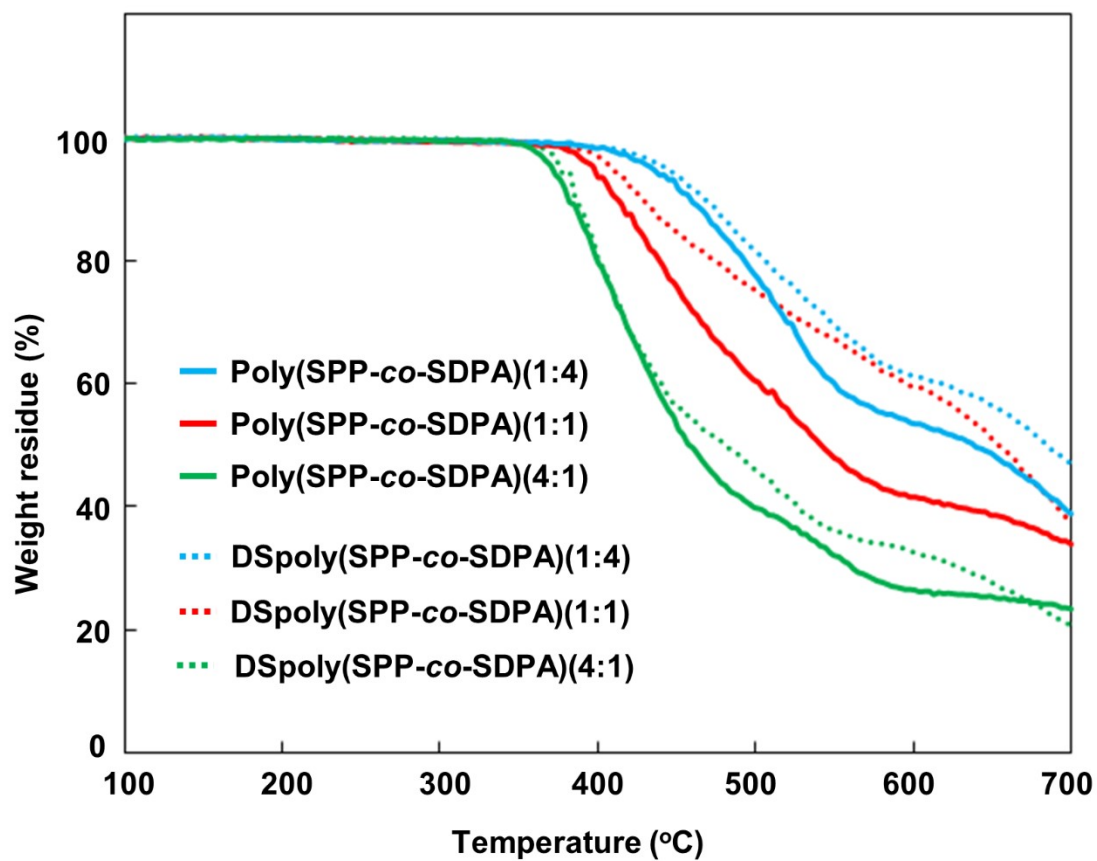


Figure S19. TGA curves of **poly(SPP-co-SDPA)s** and **DSpoly(SPP-co-SDPA)s**.