

Thermoplastic, Redox Recyclable Silicone-Lipoamide Elastomers

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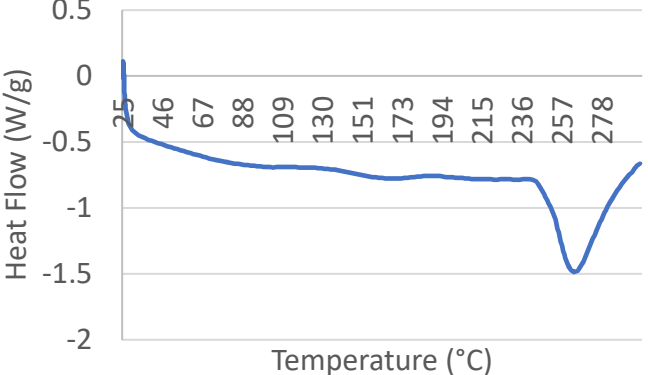
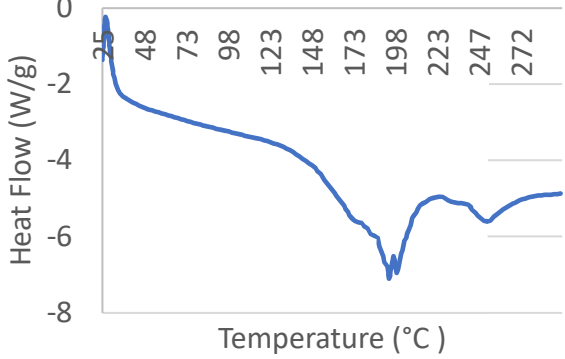
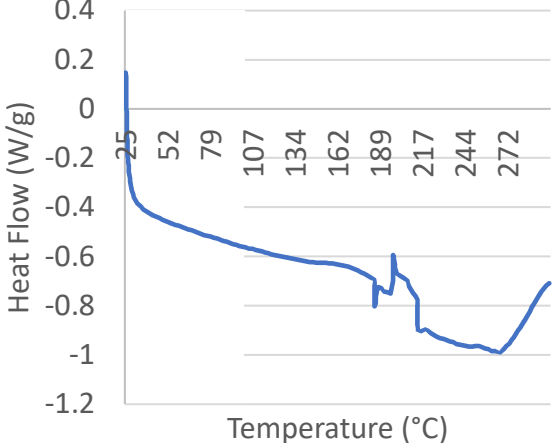
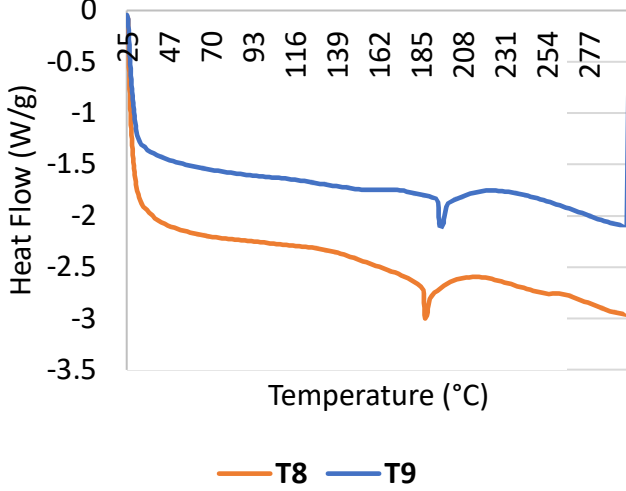
Supporting Information

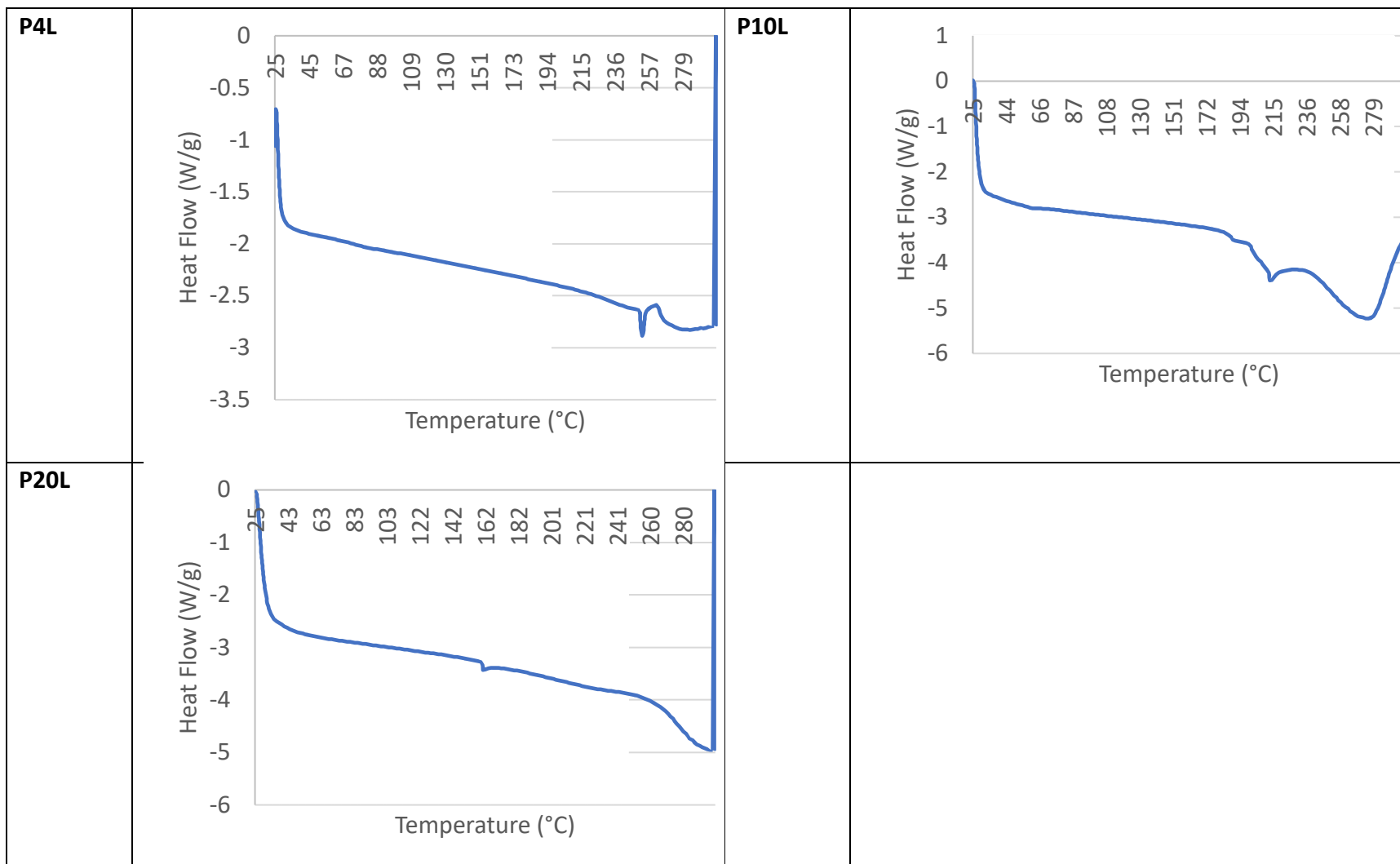
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Table S1. Synthesis of Lipoamide Silicone Copolymers.

	LPA g (mmol)	CDI g (mmol)	APS g (mmol)	Functional group equivalents [LPA]/[APS]	% Yield
S1	0.4992 (2.42)	0.4048 (2.5)	0.4353 (2.42)	1:1	90
S3	0.5027 (2.42)	0.4045 (2.5)	0.8610 (2.42)	1:1	79
T0	0.5043 (2.42)	0.4063 (2.5)	0.3022 (1.21)	1:1	86
T8	0.5003 (2.42)	0.4047 (2.5)	1.0911 (1.21)	1:1	86
T9	0.5028 (2.42)	0.4041 (2.5)	1.2163 (1.21)	1:1	86
T37	0.5030 (2.42)	0.4049 (2.5)	3.6300 (1.21)	1:1	75
P2	0.2522 (1.22)	0.2012 (1.25)	6.6685 (1.21)	1:1	88
P4	0.5017 (2.42)	0.4043 (2.5)	5.1630 (2.42)	1:1	79
P10	0.5000 (2.42)	0.4045 (2.5)	2.2301 (2.42)	1:1	92
P20	0.4997 (2.42)	0.4063 (2.5)	0.9920 (2.42)	1:1	96

Table S2. DSC traces of LPA-APS elastomers.^a

LPA-APS elastomer	DSC	LPA-APS elastomer	DSC
S1L		S3L	
TOL		T8L, T9L	



^a DSC analyses were not performed on **T37** and **P2** since they did not form elastomers.

Table S3. Time for elastomers to reform when displaying thermoplastic behavior.

LPA-APS elastomer	Melting Temperature (°C)	Time to reform Elastomer
S1L	165	3 days
S3L	197	1 day
T0L	186	1 days
T8L	188	10 min
T9L	197	2-5 days
T37L^a	-	-
P2L^a	-	-
P4L	254	10 min
P10L	216	2 hrs
P20L	160	4 hrs

^a **T37L** and **P2L** were not tested for thermoplastic behaviour since they did not form elastomers.

Table S4. Reductive elastomer degradation with 1,4-dithiotheritol.

	LPA-APS elastomer mg (mmol)	DTT mg (mmol)	Functional group equivalents [LPA]/[APS]
S1L	98.2 (0.26)	98.2 (0.26)	1:1
S3L	100.0 (0.18)	27.6 (0.18)	1:1
T0L	97.2 (0.21)	33.1 (0.21)	1:1
T8L	101.9 (0.16)	24.0 (0.16)	1:1
T9L	99.7 (0.14)	21.9 (0.14)	1:1
T37L^a	-	-	-
P2L^a	-	-	-
P4L	100.2 (0.04)	6.8 (0.04)	1:1
P10L	100.1 (0.09)	13.8 (0.09)	1:1
P20L	101.0 (0.17)	26.0 (0.17)	1:1

^a **T37L** and **P2L** did not form elastomers; no change was observed during this experiment.

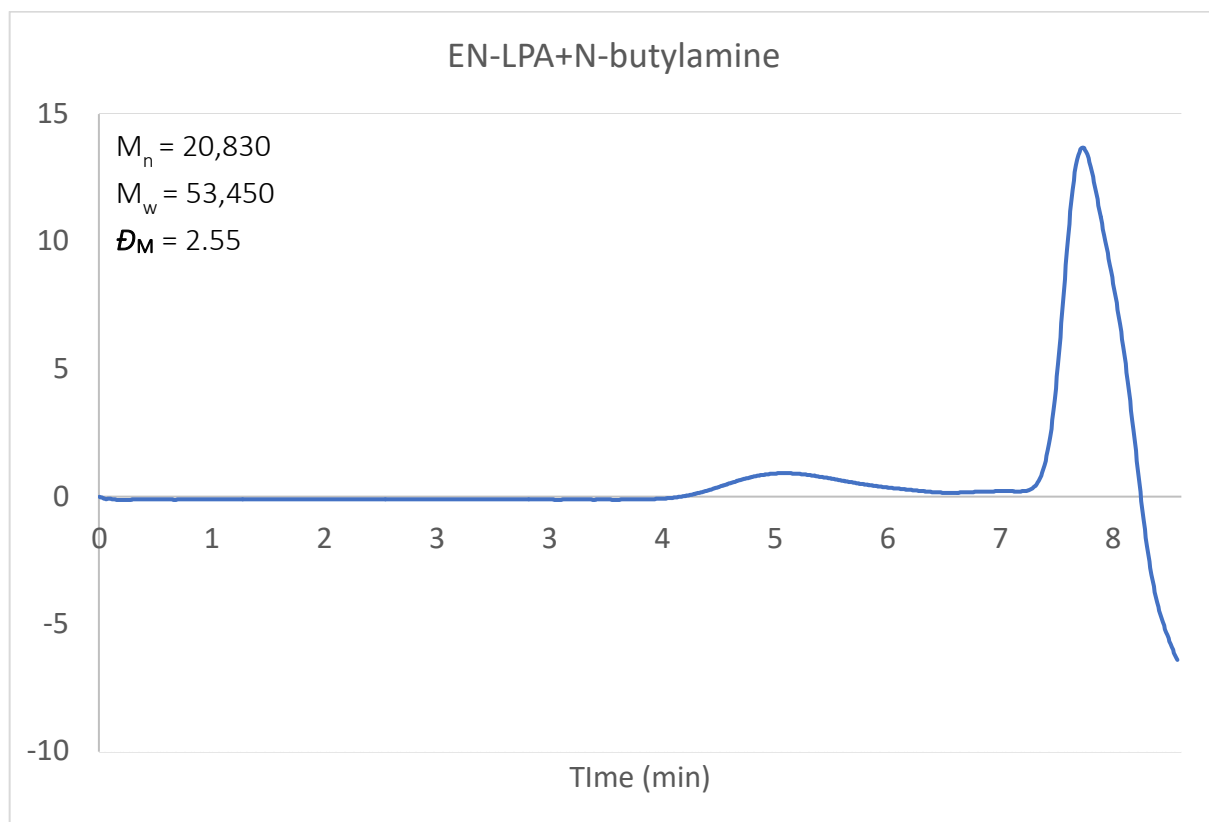


Figure S1. GPC results of LPA+butylamine elastomer **BuL-P** in THF.

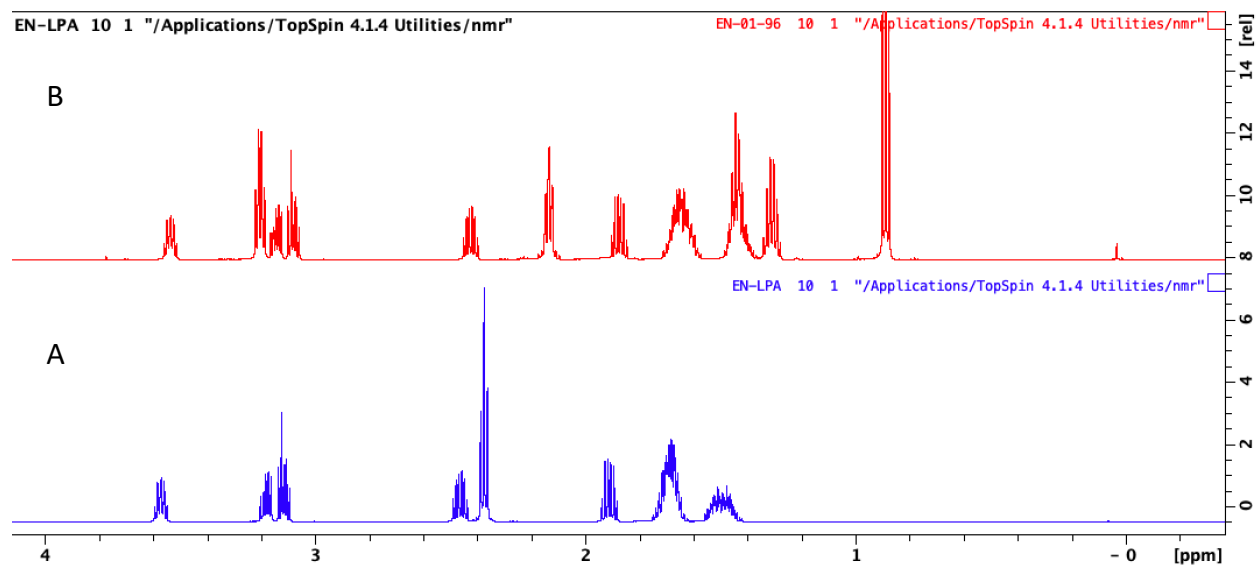


Figure S2. Confirms the complete reaction of LPA + butylamine: (A) ^1H NMR of LPA starting material, (B) ^1H NMR of LPA + butylamine product **BuL**.

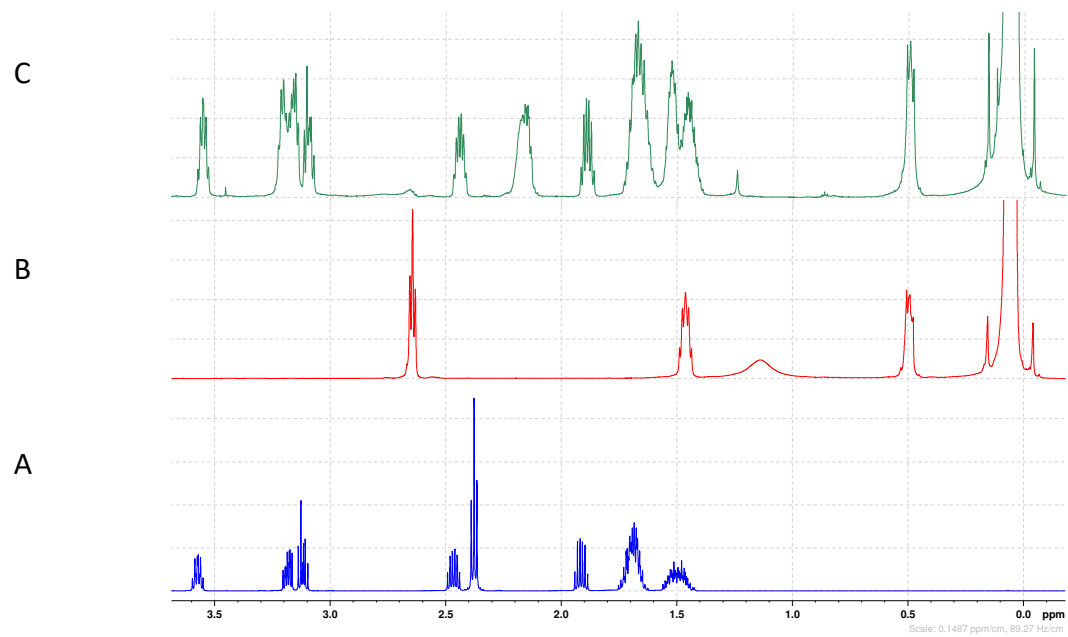


Figure S3. ¹H NMR comparison of LPA (A), APS(B) and LPA-APS copolymer(C).

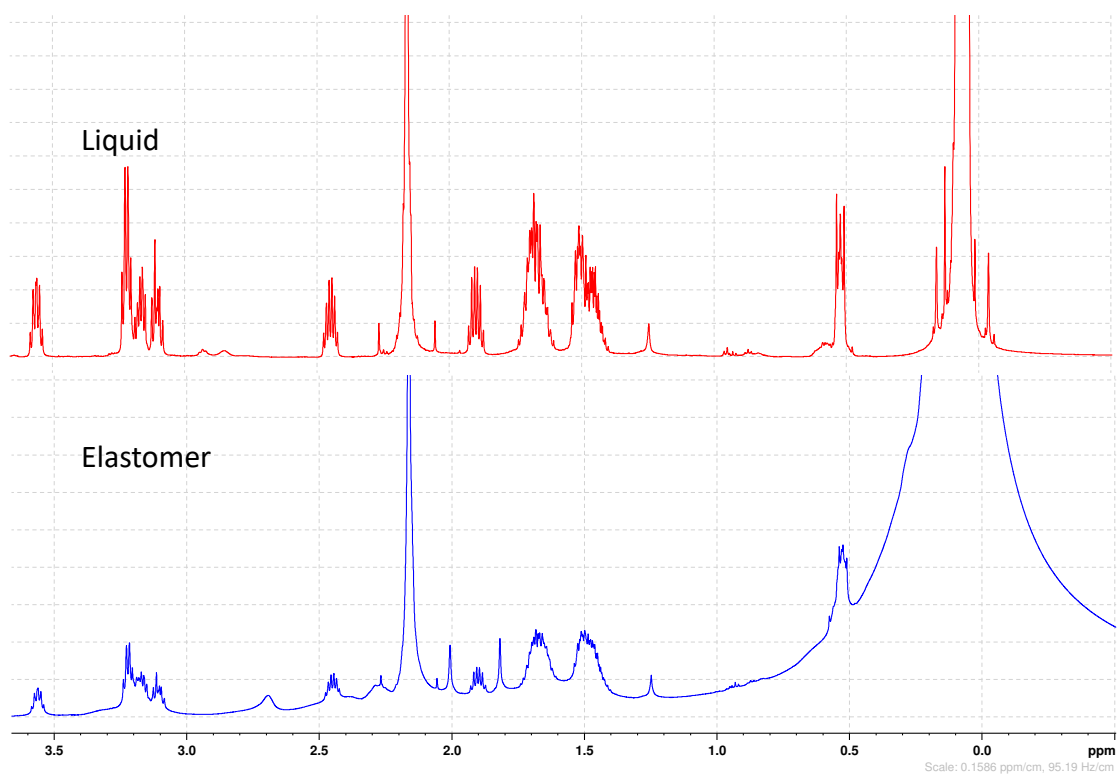


Figure S4. NMR of T8L, liquid vs elastomer.

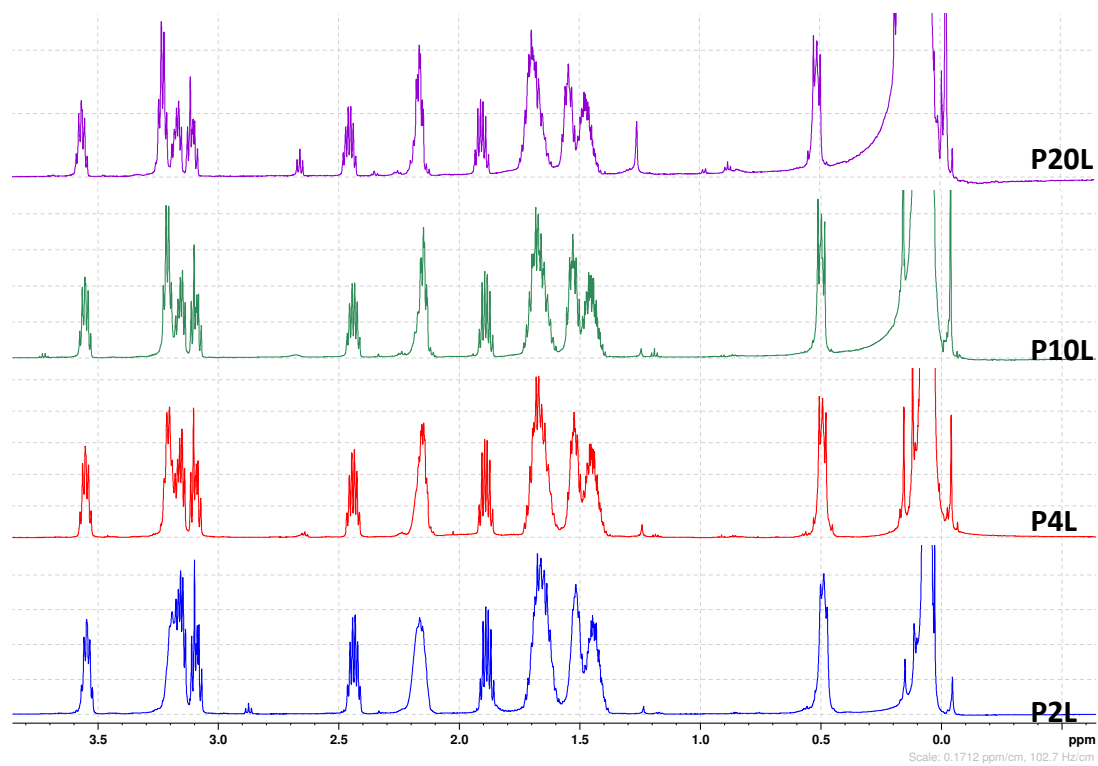


Figure S5. NMR of pendent LPA-APS co-polymer (before an elastomer had formed, within 10 minutes of reaction).

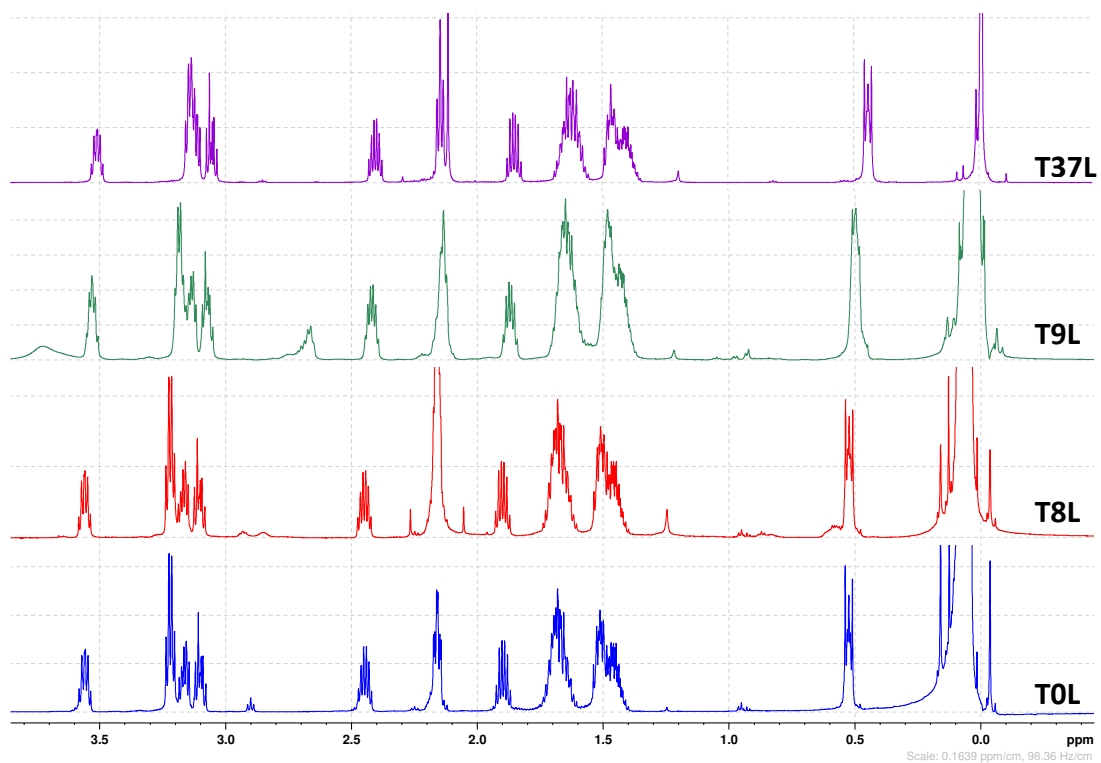


Figure S6. NMR of telechelic LPA-APS co-polymer (before an elastomer had formed, within 10 minutes of reaction).

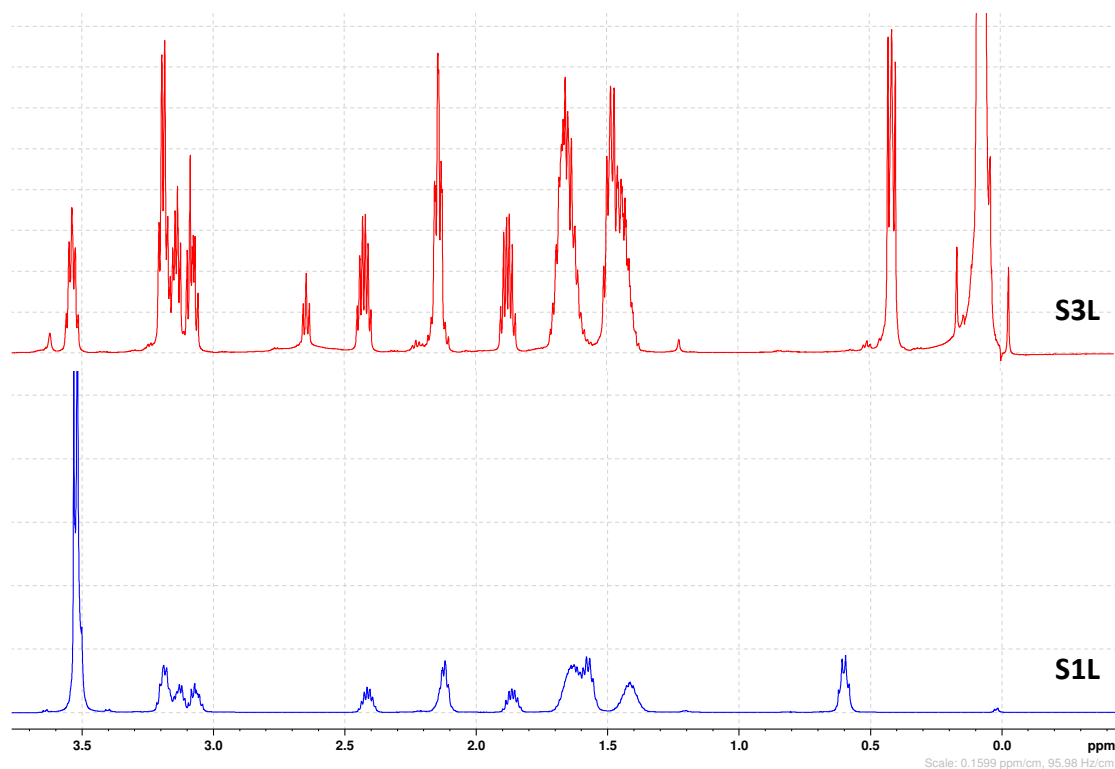


Figure S7. NMR of simple silanes LPA-APS co-polymer (before an elastomer had formed, within 10 minutes of reaction).

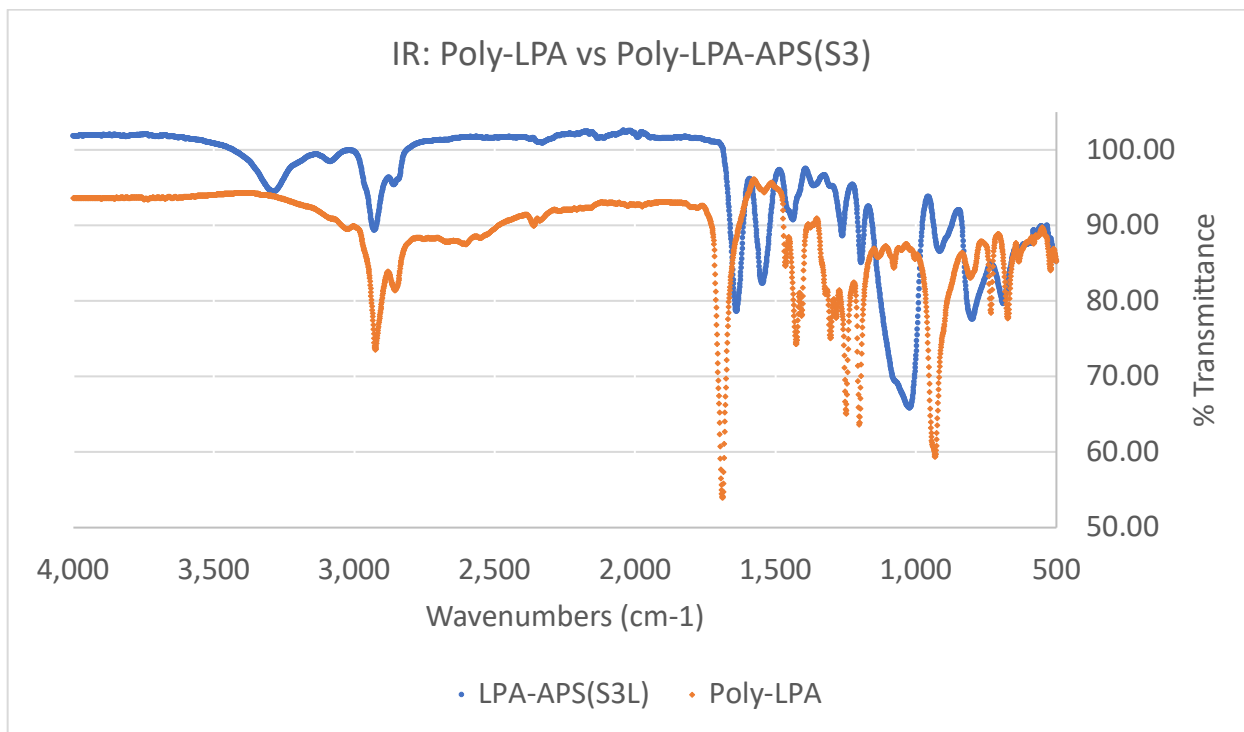


Figure S8. IR of LPA vs LPA-APS elastomer displays the shift in the carbonyl peak.

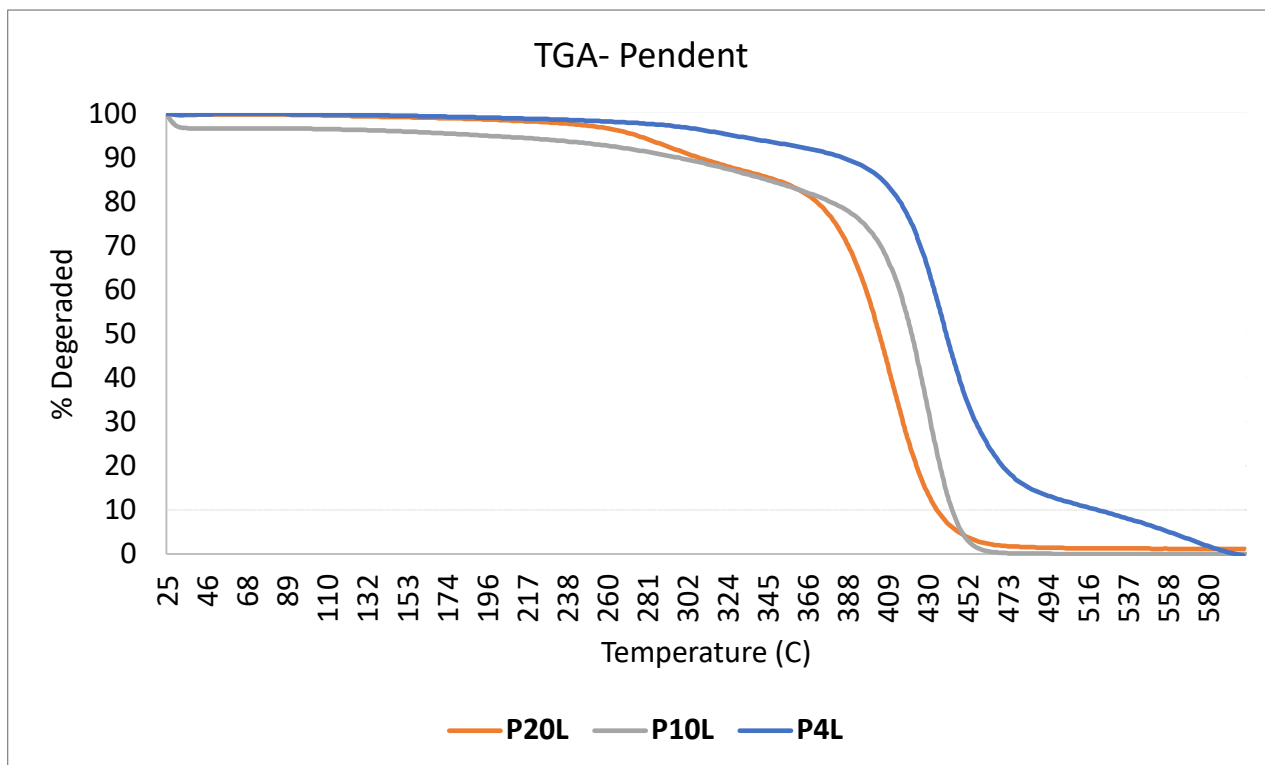


Figure S9. TGA of pendent LPA-APS elastomers.

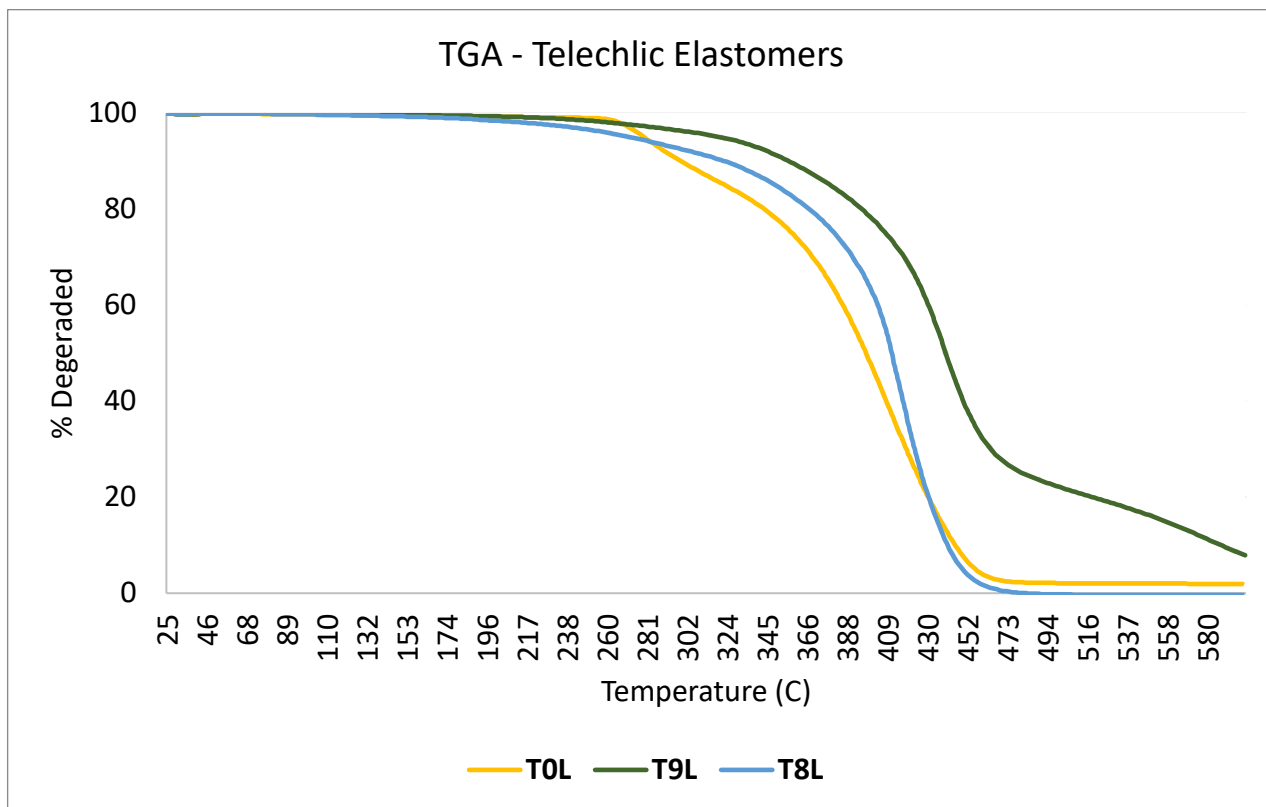


Figure S10. TGA of telechelic LPA-APS elastomers.

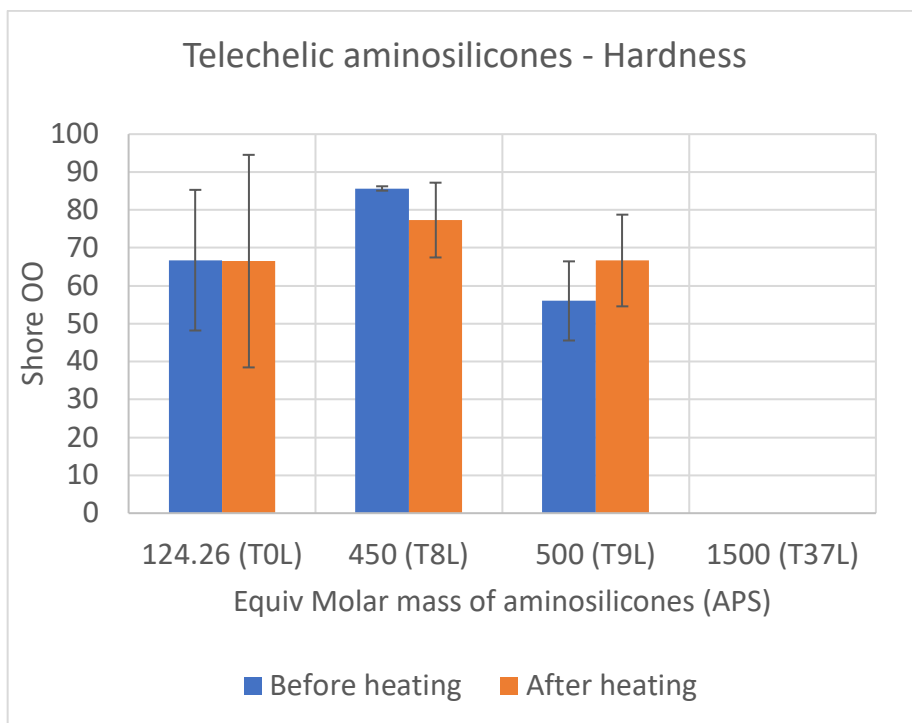


Figure S11. Shore hardness of linear LPA-APS elastomers; heating at melting point for 10 min.

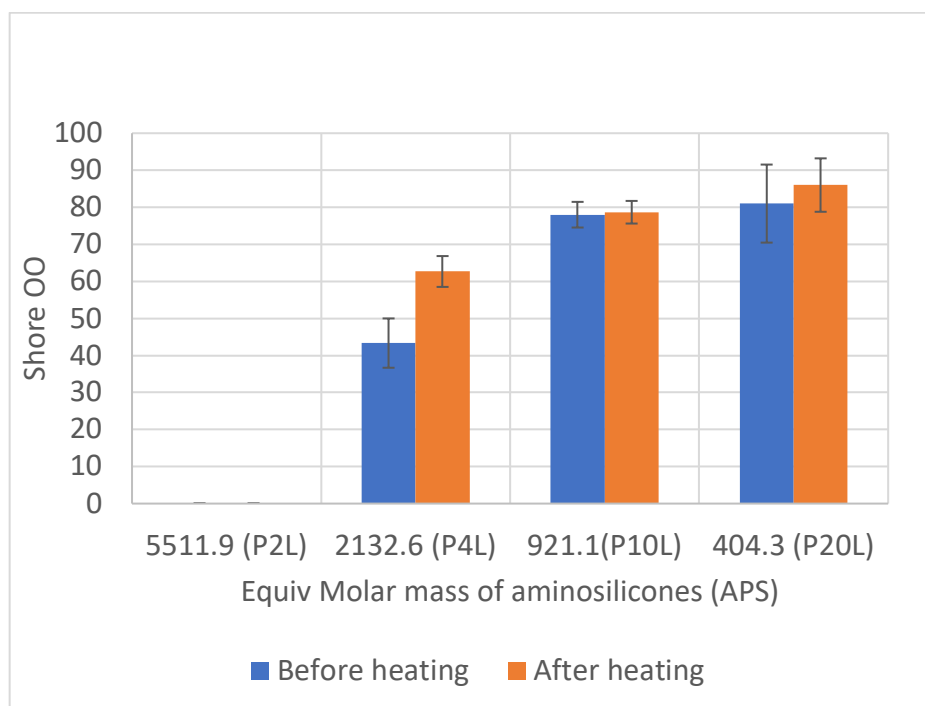


Figure S12. Shore hardness of pendent LPA-APS elastomers; heating at melting point for 10 min.

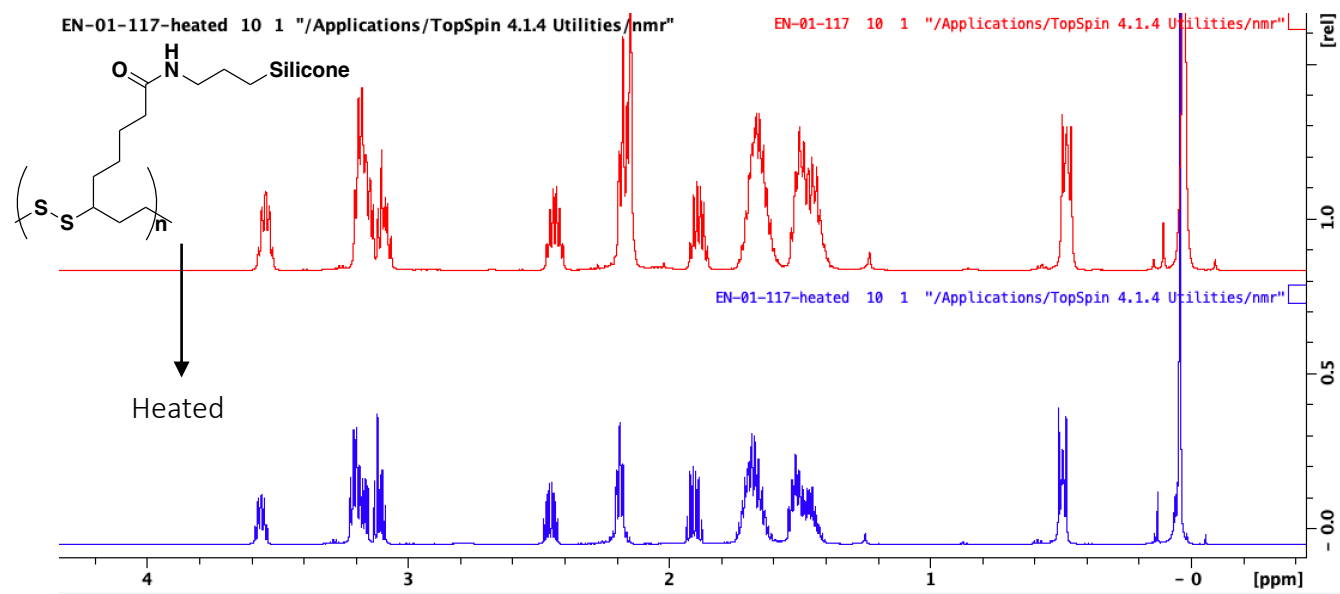


Figure S13. NMR of a linear telechelic LPA-APS copolymer (**T8L**, before it forms an elastomer) before and after heating.

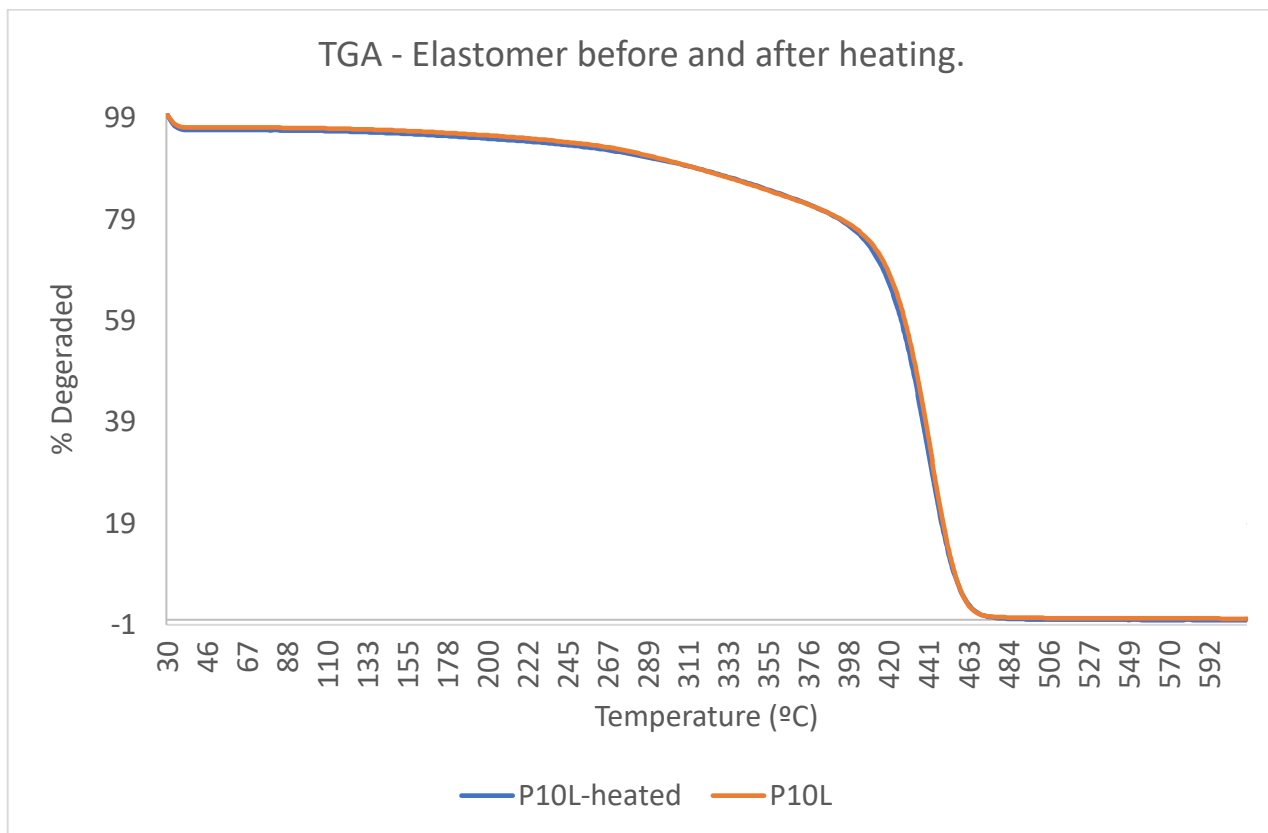


Figure S14. Comparison of the TGA of LPA-APS (**P10L**) before and after heating.

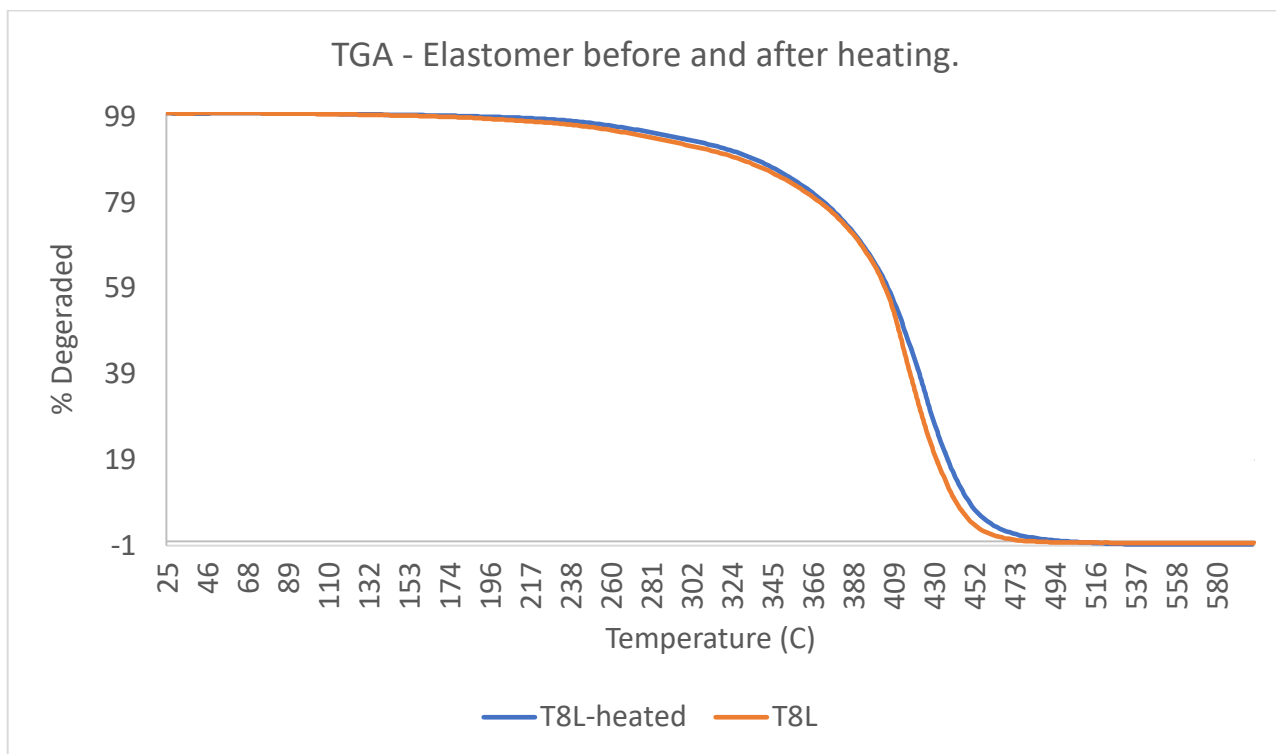


Figure S15. Comparison of the TGA of a telechelic LPA-APS (**T8L**) before and after heating.

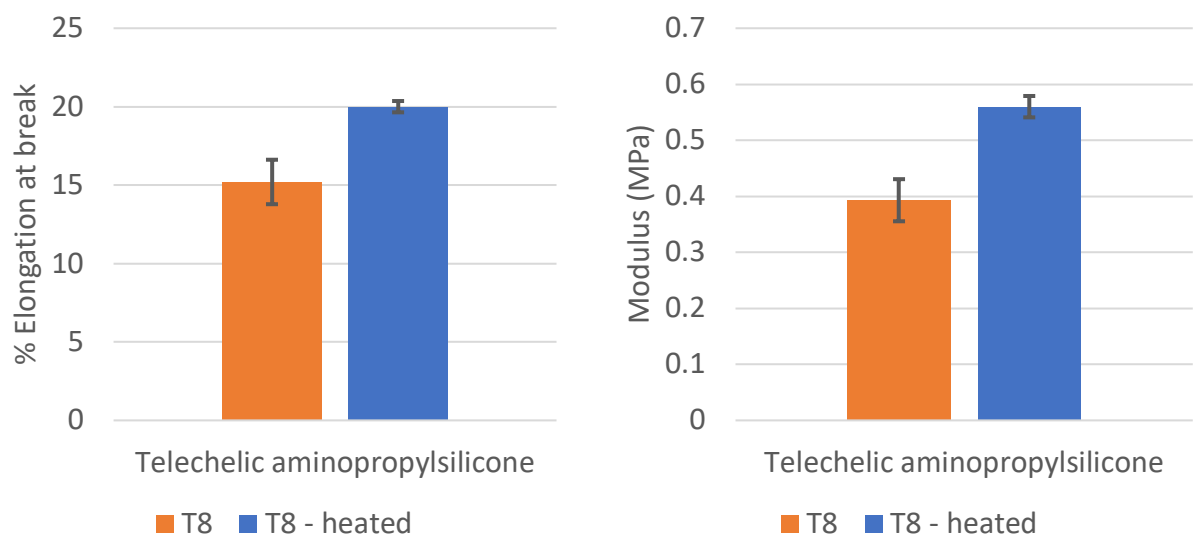


Figure S16. A: Elongation at break and Young’s modulus (tensile) of **T8L** before and after heating at the melting point (187 °C) for 10 min.

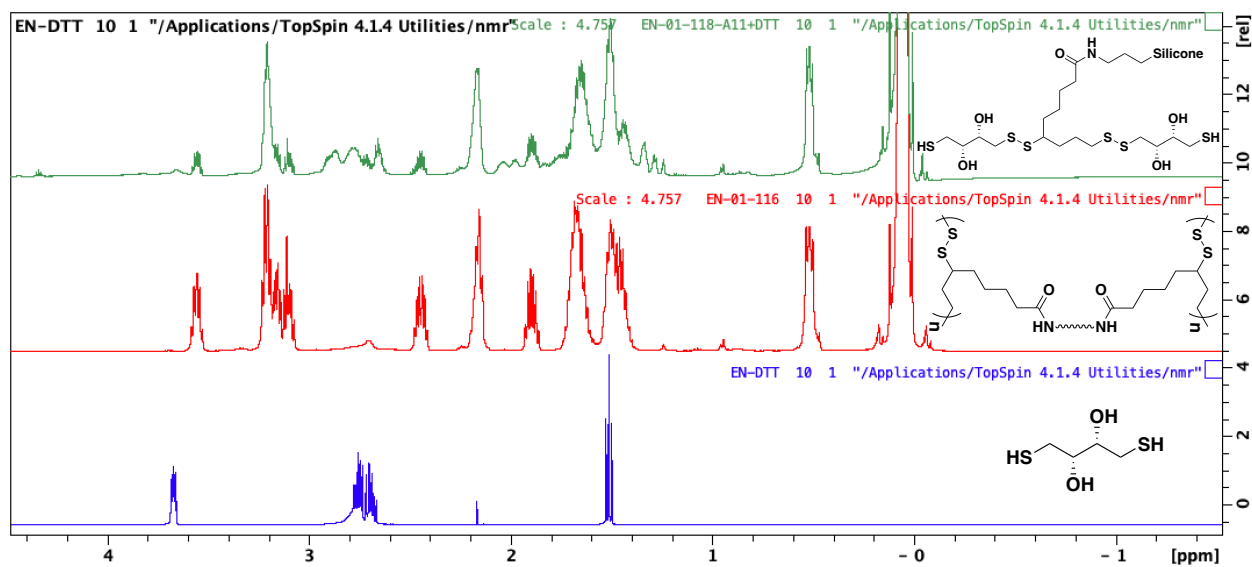


Figure S17. NMR of DTT, LPA-APS (telechelic) elastomer and Elastomer + DTT NMR.

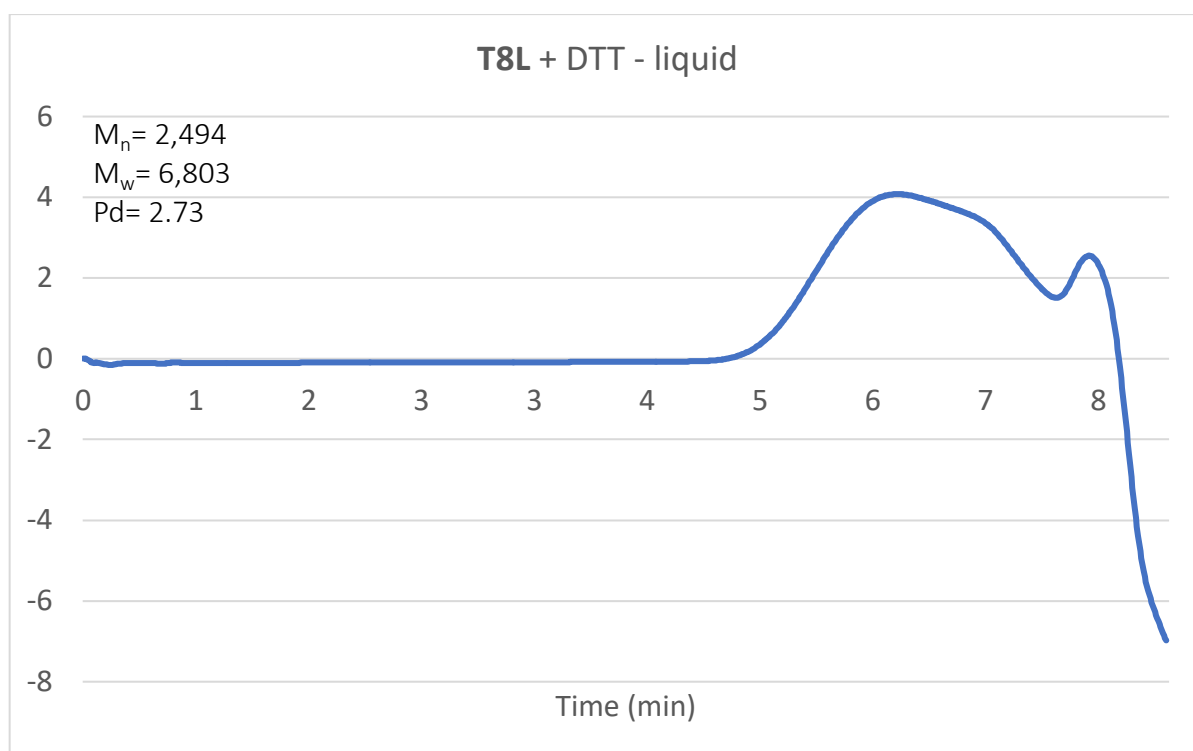
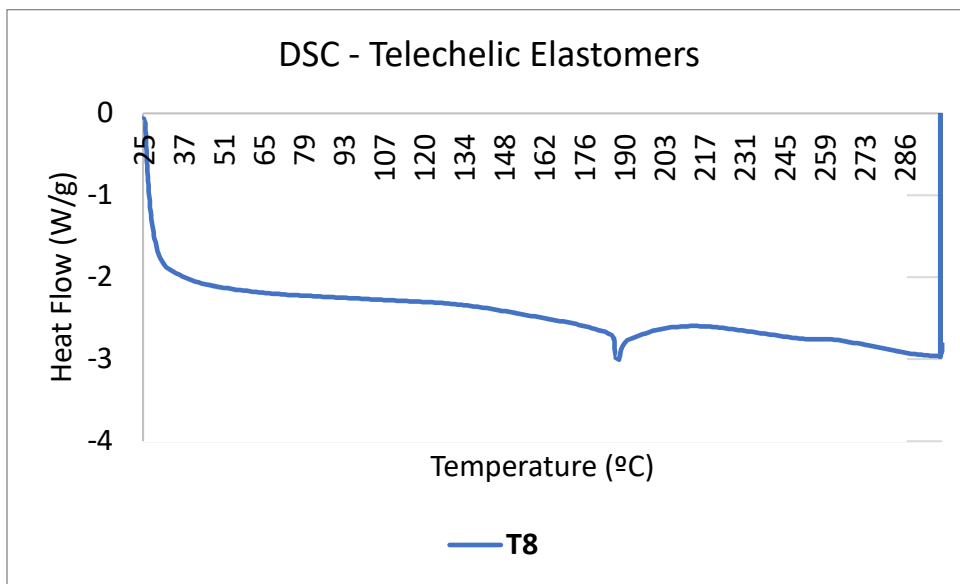


Figure S18. GPC results of LPA-APS (telechelic) elastomer + DTT product.



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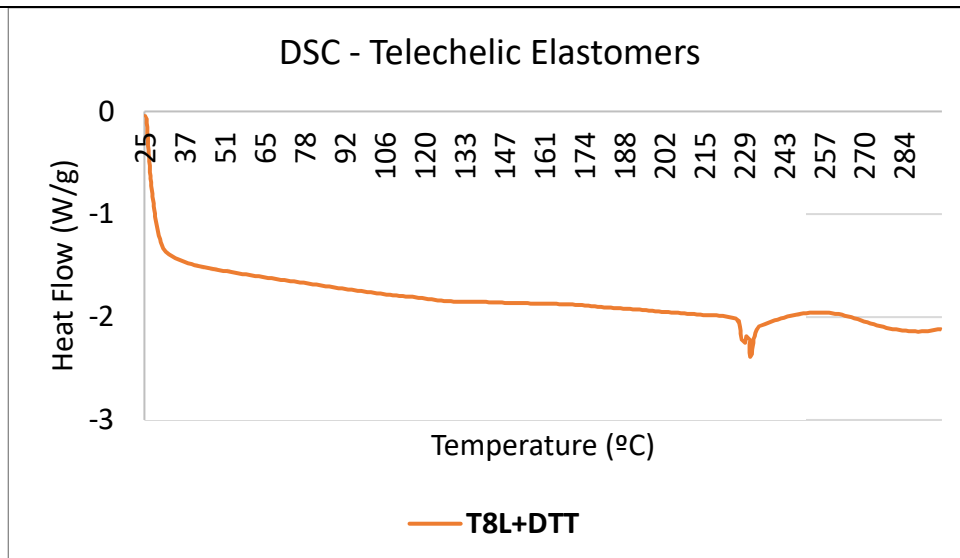


Figure S19. Comparison of LPA-APS elastomer before and after degradation with DTT.

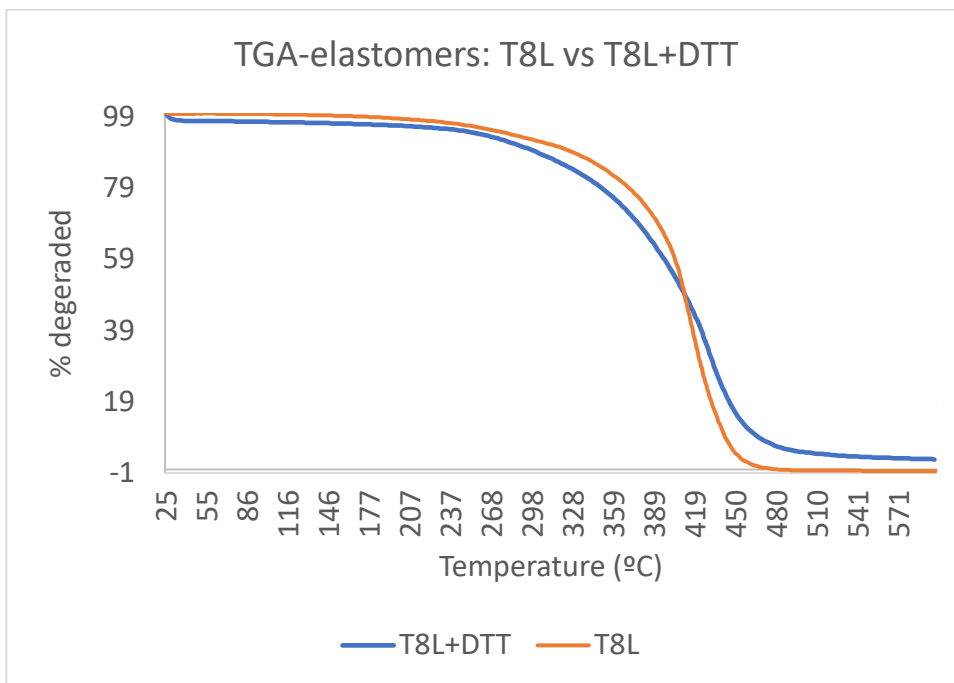


Figure S20. TGA results of **T8L** elastomer vs **T8L+DTT** elastomer.