

Supplementary Materials

Preparation and Properties of Poly(imide-siloxane) Copolymer Composite Films with Micro-Al₂O₃ Particles

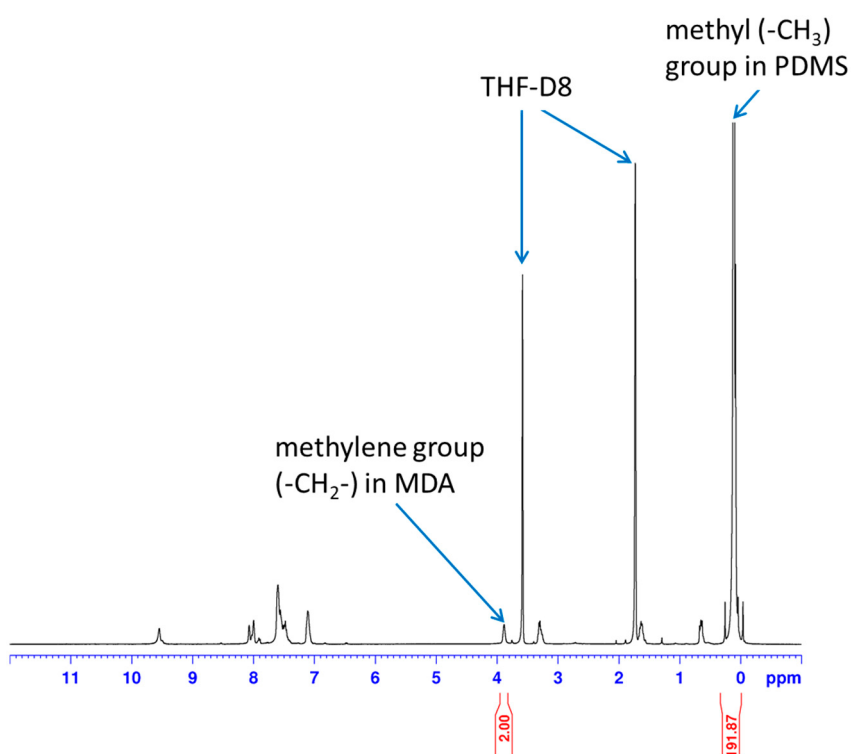


Figure S1. ¹H NMR spectrum of the PAA-4.

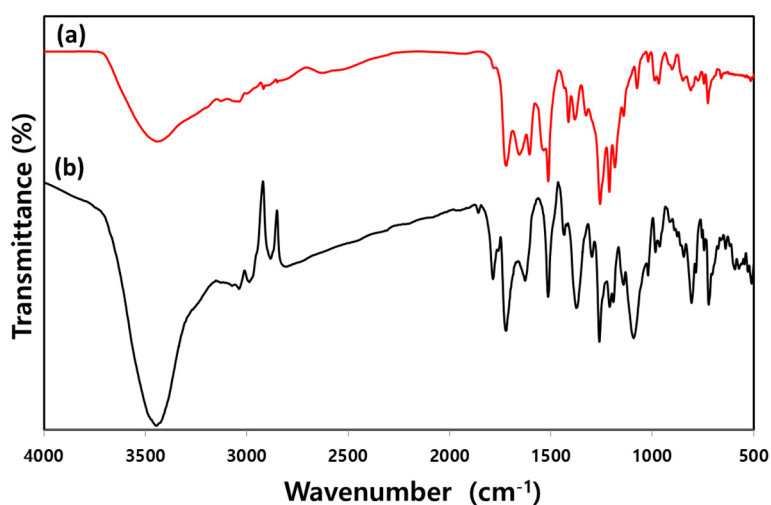


Figure S2. FT-IR spectra of (a) PAA-1, and (b) PI-1. FT-IR (KBr, cm⁻¹): (a) 1721 (carboxyl C=O stretch), 1657 (amide C=O stretch), and 1537 (amide C-N stretch); and (b) 1785 (imide C=O asymmetric stretch), 1721 (imide C=O symmetric stretch), and 1371 (imide C-N stretch).

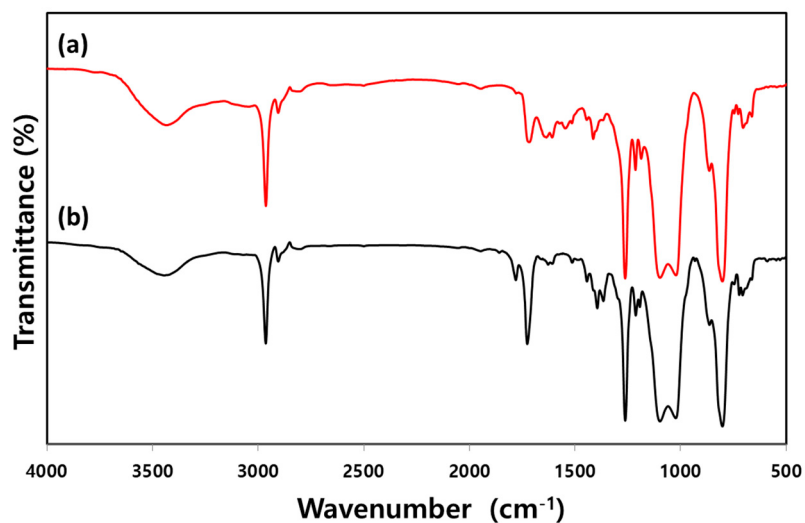


Figure S3. FT-IR spectra of (a) PAA-2, and (b) PI-2. FT-IR (KBr, cm^{-1}): (a) 1716 (carboxyl C=O stretch), 1635 (amide C=O stretch), and 1547 (amide C-N stretch); and (b) 1780 (imide C=O asymmetric stretch), 1726 (imide C=O symmetric stretch), and 1364 (imide C-N stretch).

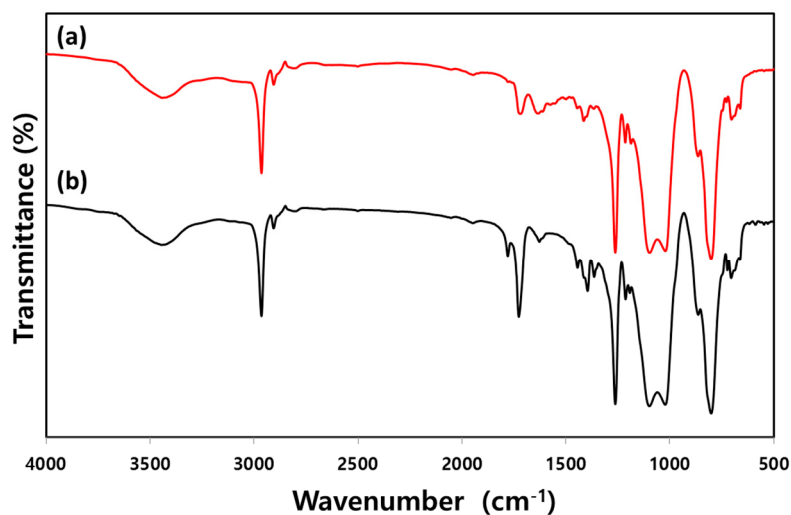


Figure S4. FT-IR spectra of (a) PAA-3, and (b) PI-3. FT-IR (KBr, cm^{-1}): (a) 1723 (carboxyl C=O stretch), 1632 (amide C=O stretch), and 1552 (amide C-N stretch); (b) 1780 (imide C=O asymmetric stretch), 1727 (imide C=O symmetric stretch), and 1364 (imide C-N stretch).

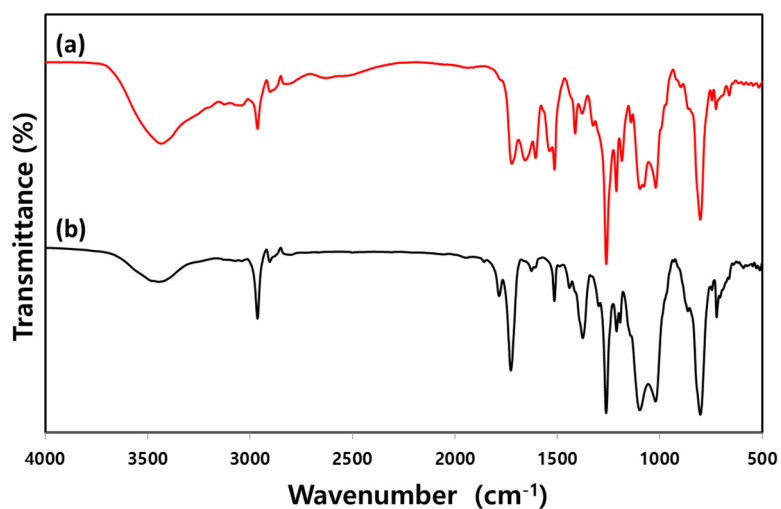


Figure S5. FT-IR spectra of (a) PAA-5 and (b) PI-5. FT-IR (KBr, cm^{-1}): (a) 1725 (carboxyl C=O stretch), 1655 (amide C=O stretch), and 1538 (amide C-N stretch); and (b) 1785 (imide C=O asymmetric stretch), 1727 (imide C=O symmetric stretch), and 1374 (imide C-N stretch).

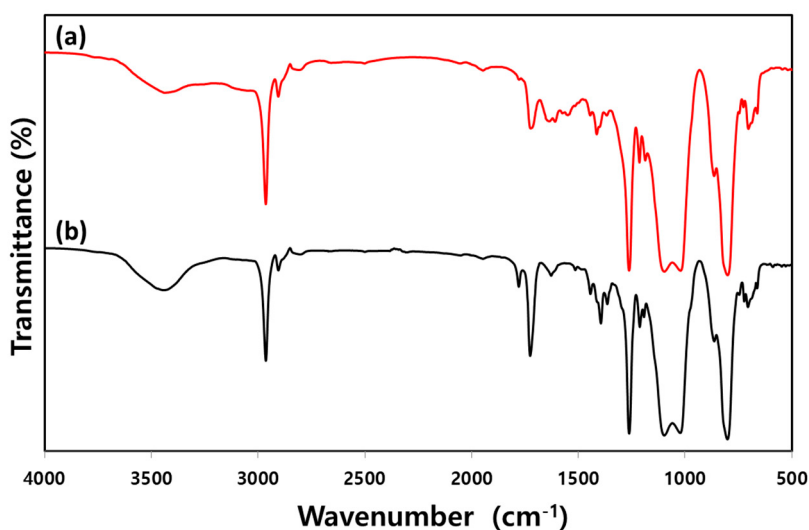


Figure S6. FT-IR spectra of (a) PAA-6, and (b) PI-6. FT-IR (KBr, cm^{-1}): (a) 1724 (carboxyl C=O stretch), 1639 (amide C=O stretch), and 1547 (amide C-N stretch); and (b) 1780 (imide C=O asymmetric stretch), 1725 (imide C=O symmetric stretch), and 1364 (imide C-N stretch).

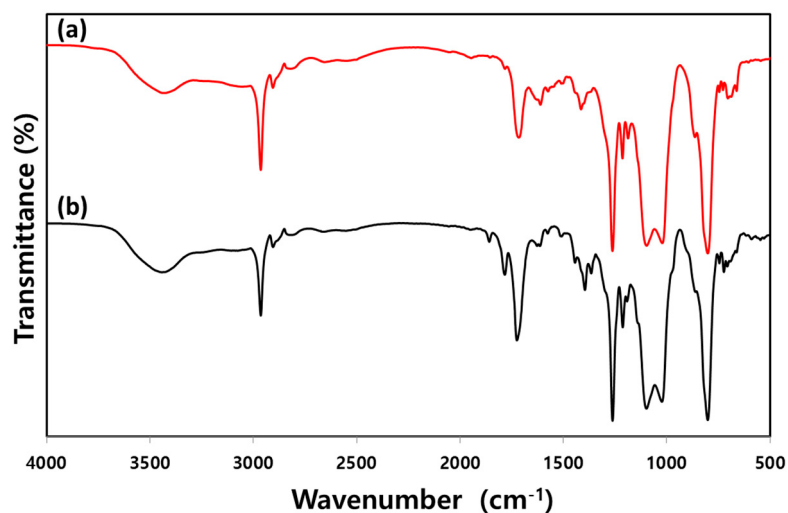


Figure S7. FT-IR spectra of (a) PAA-7, and (b) PI-7. FT-IR (KBr, cm^{-1}): (a) 1715 (carboxyl C=O stretch), 1634 (amide C=O stretch), 1547 (amide C-N stretch); (b) 1784 (imide C=O asymmetric stretch), 1725 (imide C=O symmetric stretch), and 1364 (imide C-N stretch).

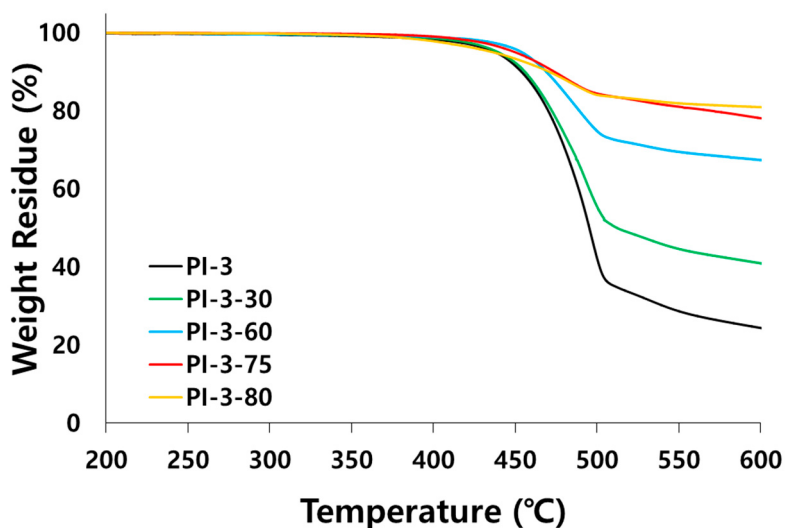


Figure S8. TGA curves of PI-3 and PI-3/ Al_2O_3 composite films.

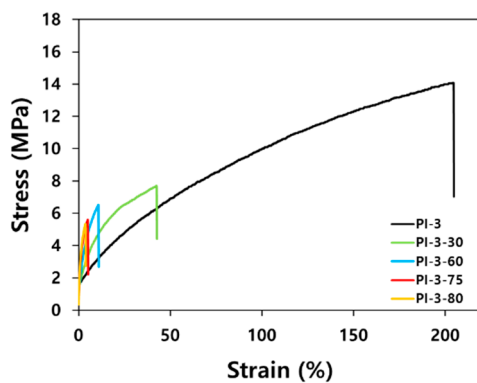


Figure S9. Stress-strain curves of PI-3 and PI-3/ Al_2O_3 composite films.

Table S1. Thermal diffusivity and thermal conductivity values of the PI-3 and PI-3/Al₂O₃ composite films.

PI/Al ₂ O ₃ composite code	Diffusivity (mm ² /s)	Conductivity (W/(m × K))	PI/Al ₂ O ₃ composite code ^a	Diffusivity (mm ² /s)	Conductivity (W/(m × K))
PI-3	0.099	0.111	PI-3-30	0.144	0.199
	0.098	0.110		0.146	0.201
	0.099	0.111		0.145	0.200
	0.099	0.111		0.146	0.202
	0.099	0.111		0.147	0.203
	0.099	0.111		0.147	0.203
	0.099	0.111		0.148	0.203
	0.100	0.112		0.148	0.204
Mean ± s.d.	0.099 ± 0.001	0.111 ± 0.001	Mean ± s.d.	0.147 ± 0.001	0.202 ± 0.002
PI-3-60	0.288	0.436	PI-3-75	0.440	0.641
	0.296	0.449		0.440	0.641
	0.298	0.452		0.437	0.636
	0.289	0.439		0.438	0.638
	0.302	0.459		0.439	0.639
	0.291	0.441		0.438	0.637
	0.304	0.462		0.438	0.637
	0.297	0.451		0.439	0.640
	-	-		0.437	0.637
	-	-		0.439	0.639
Mean ± s.d.	0.296 ± 0.006	0.449 ± 0.009	Mean ± s.d.	0.438 ± 0.001	0.638 ± 0.002
PI-3-80	0.736	1.346			
	0.738	1.352			
	0.735	1.327			
	0.732	1.321			
	0.733	1.324			
	0.733	1.323			
	0.736	1.347			
	0.734	1.324			
Mean ± s.d.	0.728 ± 0.007	1.333 ± 0.013			

Table S2. Thermal diffusivity and thermal conductivity values of the PI-4 and PI-4/Al₂O₃ composite films.

PI/Al ₂ O ₃ composite code	Diffusivity (mm ² /s)	Conductivity (W/(m × K))	PI/Al ₂ O ₃ composite code ^a	Diffusivity (mm ² /s)	Conductivity (W/(m × K))
PI-4	0.104	0.125	PI-4-30	0.123	0.140
	0.105	0.126		0.123	0.140
	0.104	0.125		0.123	0.141
	0.104	0.125		0.123	0.141
	0.104	0.125		0.120	0.137
	0.105	0.126		0.120	0.137
	0.105	0.126		0.120	0.138
	0.104	0.125		0.121	0.138
Mean ± s.d.	0.104 ± 0.000	0.125 ± 0.000	Mean ± s.d.	0.122 ± 0.001	0.139 ± 0.001
PI-4-60	0.208	0.287	PI-4-75	0.389	0.677
	0.209	0.288		0.388	0.675
	0.211	0.290		0.389	0.677
	0.210	0.289		0.379	0.659
	0.210	0.289		0.388	0.676
	0.211	0.290		0.389	0.677
	0.210	0.290		0.389	0.678
	0.211	0.290		0.389	0.678
	-	-		0.381	0.664
	-	-		0.389	0.677
Mean ± s.d.	0.210 ± 0.001	0.289 ± 0.001	Mean ± s.d.	0.387 ± 0.004	0.674 ± 0.007
PI-4-80	0.708	1.337			
	0.697	1.318			
	0.707	1.337			
	0.726	1.371			
	0.702	1.327			
	0.719	1.360			
	0.732	1.383			
	0.734	1.387			
Mean ± s.d.	0.716 ± 0.014	1.352 ± 0.026			

Table S3. Thermal diffusivity and thermal conductivity values of the PI-5 and PI-5/Al₂O₃ composite films.

PI/Al ₂ O ₃ composite code	Diffusivity (mm ² /s)	Conductivity (W/(m × K))	PI/Al ₂ O ₃ composite code ^a	Diffusivity (mm ² /s)	Conductivity (W/(m × K))
PI-5	0.102	0.132	PI-5-30	0.114	0.162
	0.104	0.133		0.113	0.161
	0.105	0.135		0.114	0.162
	0.106	0.136		0.113	0.161
	0.107	0.137		0.114	0.163
	0.107	0.137		0.114	0.162
	0.108	0.139		0.115	0.163
	0.109	0.140		0.118	0.167
Mean ± s.d.	0.106 ± 0.002	0.136 ± 0.003	Mean ± s.d.	0.114 ± 0.001	0.163 ± 0.002
PI-5-60	0.217	0.272	PI-5-75	0.390	0.539
	0.221	0.278		0.384	0.531
	0.221	0.277		0.390	0.539
	0.222	0.278		0.391	0.541
	0.223	0.280		0.388	0.537
	0.222	0.279		0.390	0.538
	0.222	0.278		0.390	0.539
	-	-		0.390	0.540
	-	-		0.390	0.539
	-	-		0.392	0.542
Mean ± s.d.	0.221 ± 0.002	0.277 ± 0.002	Mean ± s.d.	0.390 ± 0.002	0.538 ± 0.003
PI-5-80	0.483	0.891			
	0.482	0.890			
	0.484	0.894			
	0.487	0.900			
	0.488	0.902			
	0.483	0.892			
	0.486	0.898			
	0.488	0.901			
Mean ± s.d.	0.485 ± 0.003	0.896 ± 0.005			