Supporting information for

Tailoring the properties of semi-aromatic copolyimides through structural manipulation towards energy-storage applications

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Table S1. Performance of commercial polyimides and of some developed polyimide films.

Material	T_g (°C)	ε_r (25°C, 1 kHz)	tan δ (25°C)	E_b (MV/m)	Ue (J/cm³)	Reference
Ultem®	217	3.2–3.1	~0.3	439 (150°C)	1.14	1
Kapton®	360	3.3–2.8	0.1	154–303 (7.6–127 μm)	0.59	2
Upilex-S	355	3.3	0.1	272	-	3
BTDA-HK511	78	7.8	0.555	676	15.77	4
BTDA-HK25-HDA	150	4.77	<0.01	775	12	5
PI-PEI (50%-50%)	248	3	~0.17	1000	8	6
ODPA-pDS	290	5.98	0.00373	536	7.60	7
BTDA-BPBPA	296	7.2	0.038	295	2.77	8
BTDA-2CN	325	4.8	0.00157	219	1.02	9

Table S2. Co-monomer ratio of copolyimides coPI1–coPI9.

Copoly-imides	Targeted molar ratio of the structural units		Experimental molar ratio of the structural units from ^{1}H-NMR		Experimental wt. % ratio of structural units from ^{1}H-NMR	
	Ar-BTDA	J-BTDA	Ar-BTDA	J-BTDA	Ar-BTDA	J-BTDA
coPI1	0.7	0.3	0.65	0.35	56.31	43.69
coPI2	0.7	0.3	0.64	0.36	47.71	52.29
coPI3	0.7	0.3	0.79	0.21	50.24	49.76
coPI4	0.6	0.4	0.55	0.45	44.93	55.07
coPI5	0.6	0.4	0.59	0.41	42.30	57.70
coPI6	0.6	0.4	0.63	0.37	31.25	68.75
coPI7	0.5	0.5	0.46	0.54	36.82	63.18
coPI8	0.5	0.5	0.43	0.57	27.72	72.28
coPI9	0.5	0.5	0.58	0.42	26.89	73.11

Table S3. Solubility of copolyimides coPI1–coPI9.

Copoly-imide	Solvent							
	$CHCl_3$	THF	ACN	DCM	DMF	DMAc	DMSO	NMP
coPI1	++	++	±	++	++	++	++	++
coPI2	++	++	±	++	++	++	++	++
coPI3	±	++	–	±	++	++	++	++
coPI4	++	++	±	++	++	++	++	++
coPI5	++	++	±	++	++	++	++	++
coPI6	++	++	±	++	++	++	++	++
coPI7	++	++	±	++	++	++	++	++
coPI8	++	++	±	++	++	++	++	++
coPI9	++	++	±	++	++	++	++	++

++ soluble at room temperature; ± partially soluble

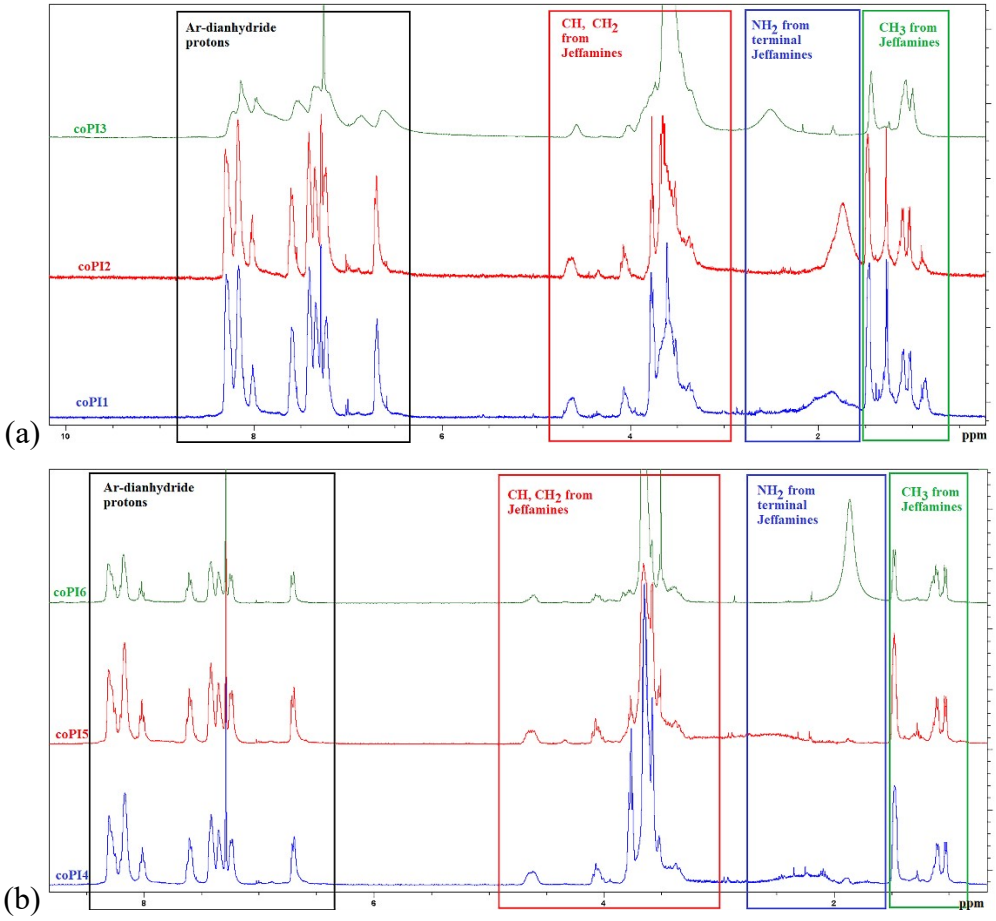

Figure S1. ^{1}H-NMR spectra of copolyimides (a) coPI1–coPI3 obtained from a molar ratio between aromatic diamine and aliphatic diamine of 0.7:0.3, and (b) coPI4–coPI6 obtained from a molar ratio between aromatic diamine and aliphatic diamine of 0.6:0.4.

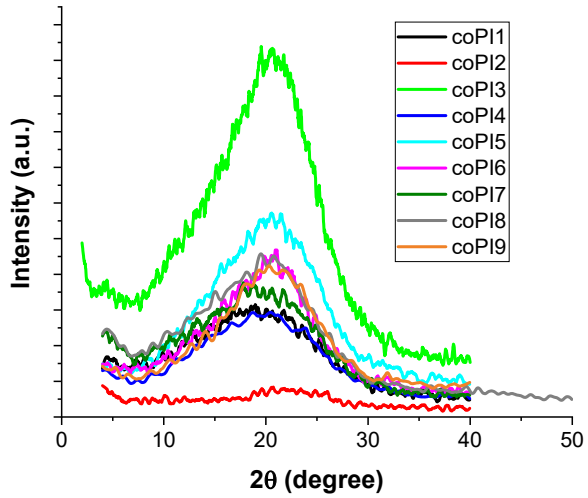

Figure S2. WAXD patterns of copolyimides coPI1–coPI9.

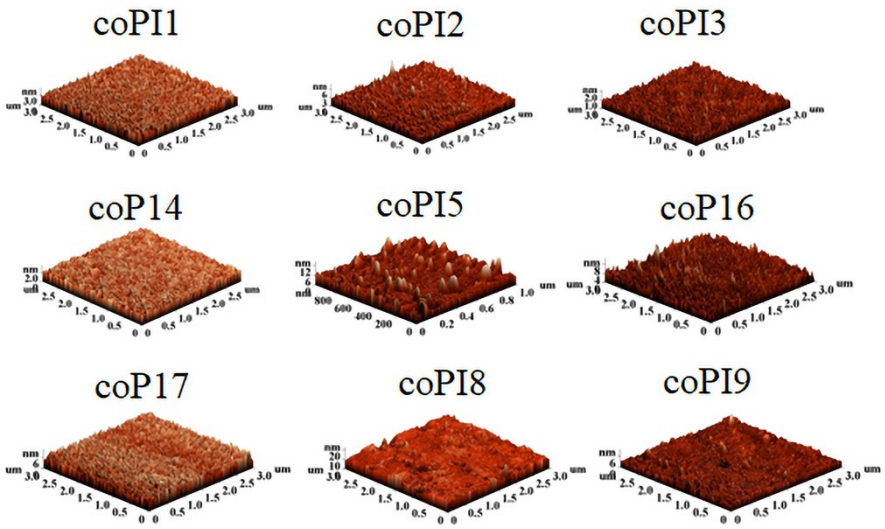

Figure S3. AFM topography 3D images of copolyimides coPI1–coPI9.

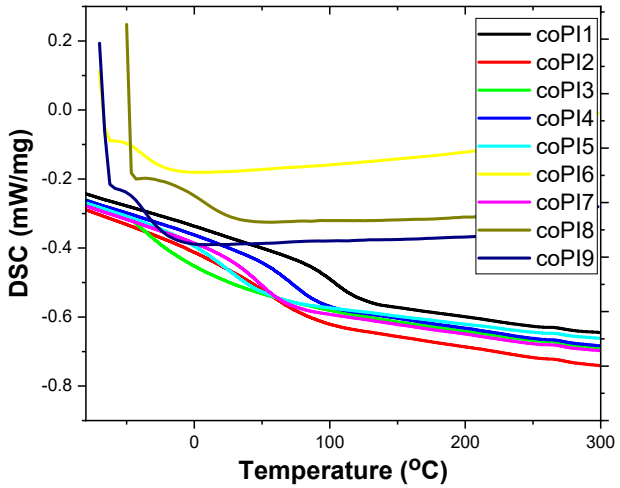

Figure S4. DSC curves of copolyimides coPI1–coPI9.

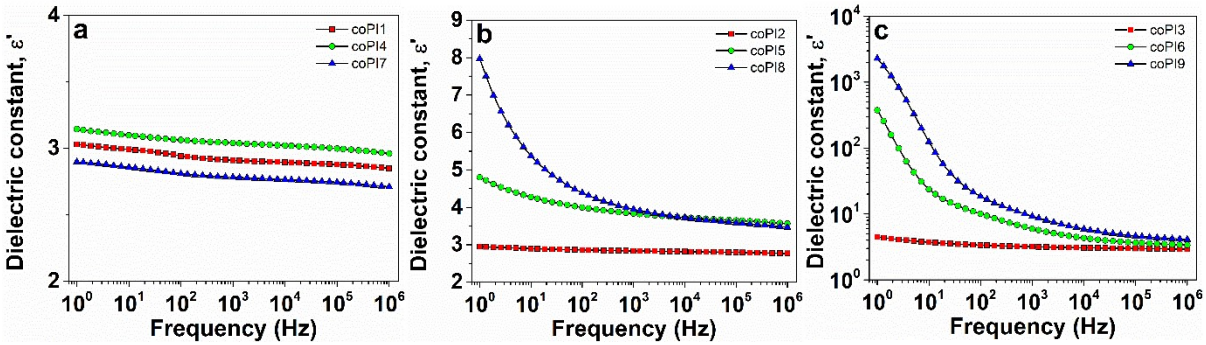

Figure S5. The evolution of dielectric constant with frequency at room temperature for copolyimides incorporating (a) J-600, (b) J-900 and (c) J-2000.

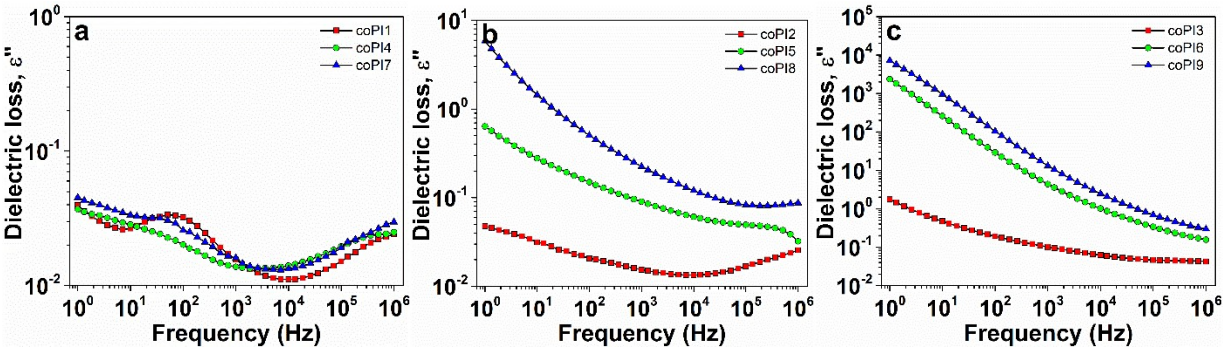

Figure S6. The evolution of dielectric loss with frequency at room temperature for copolyimides based on (a) J-600, (b) J-900 and (c) J-2000.

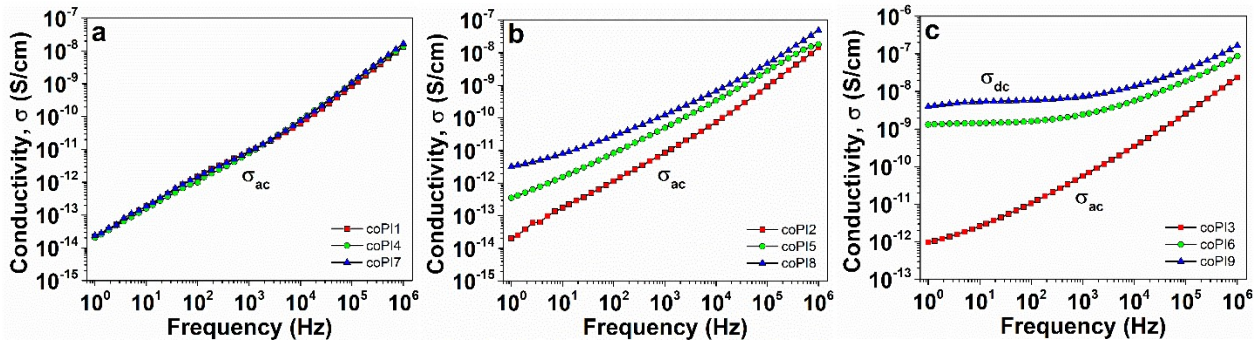

Figure S7. The evolution of conductivity with frequency at room temperature for copolyimides containing (a) J-600, (b) J-900 and (c) J-2000.

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