

Morphological control for high proton conduction in robust Co_3O_4 -diethylmethylamine (metal-organic framework) membrane

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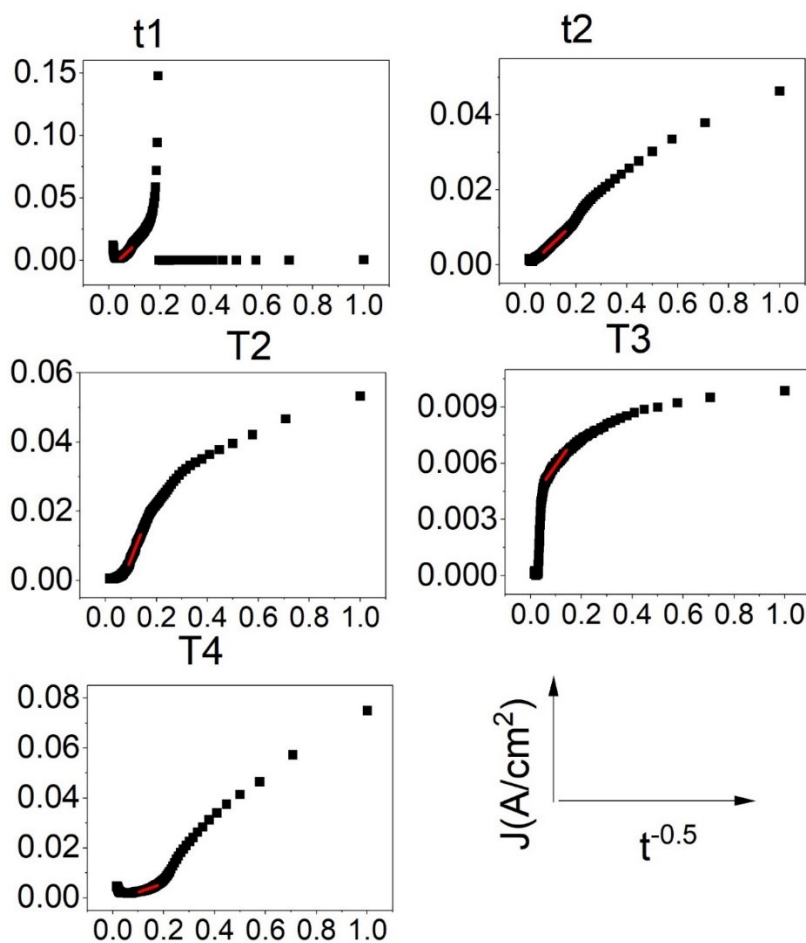


Fig. S1 Shoup-Szabo fitting for all the samples

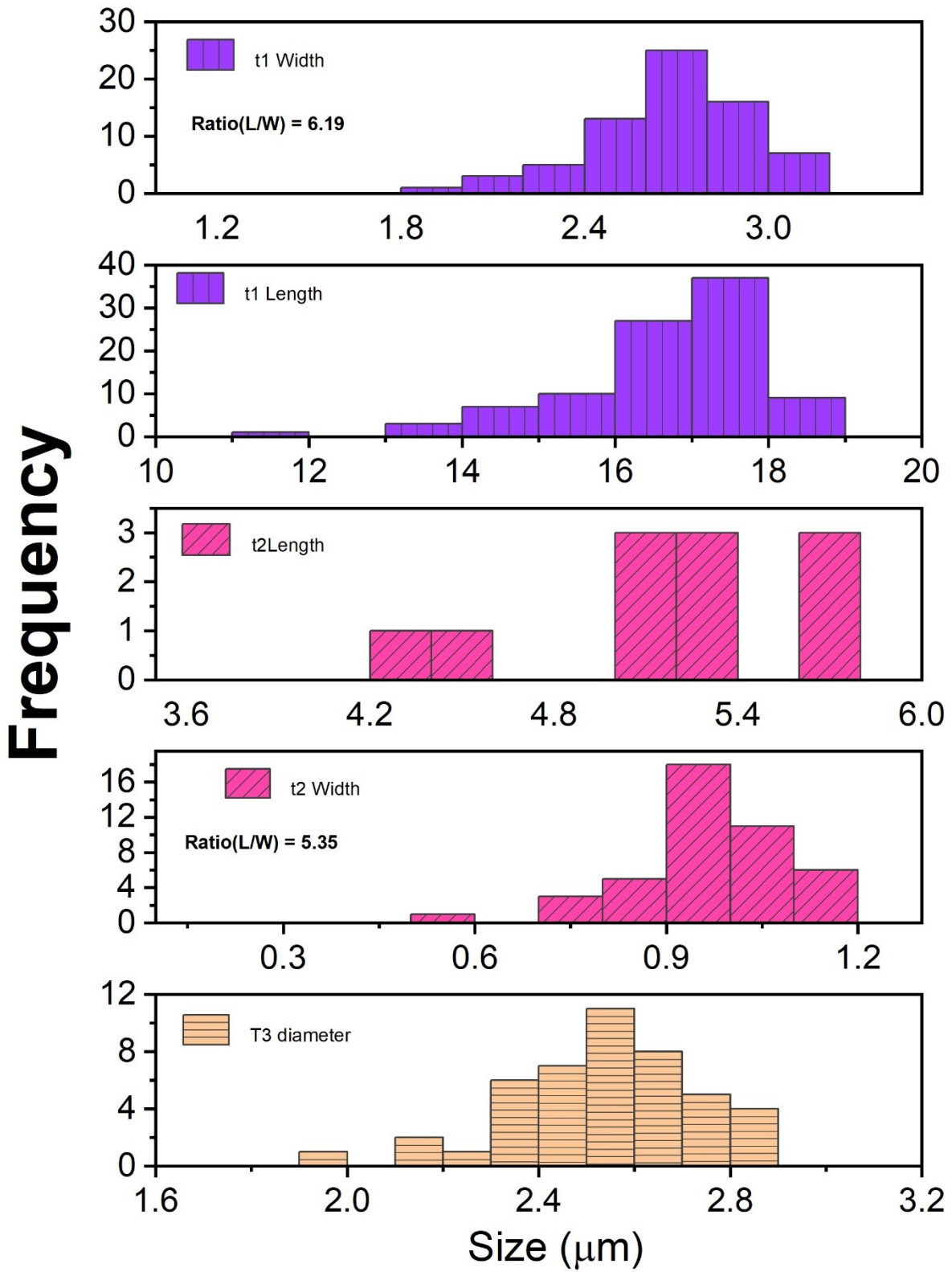


Figure S2 Grain size histograms for all the samples

Table S1 Wyckoff positions of CP glass with $P3_121$ symmetry

Atom	Ox.	Wyck.	Site	S.O.F.	x/a	y/b	z/c	U [\AA^2]
Co1		6c	1		0.11837	0.02439	0.78276	0.0961
N2		6c	1		0.06590	0.28460	0.30060	0.0961
C3		6c	1		-0.00030	0.22590	0.24610	0.0961
N4		6c	1		-0.16200	0.11010	0.27710	0.0961
C5		6c	1		0.04520	0.09450	0.36200	0.0961
C6		6c	1		0.09440	0.19560	0.37500	0.0961
N7		6c	1		0.22770	0.04810	0.64010	0.0961
C8		6c	1		0.25220	-0.00980	0.53320	0.0961
N9		6c	1		0.32190	0.03370	0.47030	0.0961
C10		6c	1		0.33960	0.13520	0.54380	0.0961
C11		6c	1		0.28350	0.14200	0.64400	0.0961
H31		6c	1		-0.03620	0.26600	0.18080	0.0961
H51		6c	1		0.05590	0.01830	0.40060	0.0961
H61		6c	1		0.14140	0.20680	0.44010	0.0961
H81		6c	1		0.22570	-0.08600	0.51060	0.0961

H101	6c	1	0.38640	0.19030	0.52090	0.0961
H111	6c	1	0.27900	0.27080	0.70320	0.0961

Table S2 Bond lengths and bond angles of CP glass with P3₁21 symmetry

	(Atom 1	atom 2	d12	atom 3	d13	angle 213)
C3	Co1	2.0111(7)	N4	2.2821(7)	113.827(15)	
C5	C6	1.2240(4)	N7	1.5923(5)	43.253(7)	
	C6	1.2240(4)	C11	1.9947(6)	38.642(6)	
	C6	1.2240(4)	H51	2.0874(10)	83.539(16)	
	N7	1.5923(5)	C11	1.9947(6)	29.904(5)	
	N7	1.5923(5)	H51	2.0874(10)	121.629(10)	
	C11	1.9947(6)	H51	2.0874(10)	119.965(8)	
C6	N7	1.0930(3)	C5	1.2240(4)	86.627(14)	
	N7	1.0930(3)	C11	1.2896(5)	48.985(13)	
	N7	1.0930(3)	H51	2.2979(7)	140.998(14)	
	C5	1.2240(4)	C11	1.2896(5)	105.009(10)	
	C5	1.2240(4)	H51	2.2979(7)	64.503(8)	
	C11	1.2896(5)	H51	2.2979(7)	159.513(11)	
N7	C11	1.0038(3)	C6	1.0930(3)	75.773(17)	
	H81	1.3456(6)	H101	2.2091(6)	109.158(8)	
	H81	1.3456(6)	H61	2.4978(7)	147.309(12)	
	C10	1.6064(5)	H101	2.2091(6)	33.958(5)	
	C10	1.6064(5)	H61	2.4978(7)	46.326(6)	
	H101	2.2091(6)	H61	2.4978(7)	69.251(8)	
C10	H101	1.2545(6)	C8	1.6064(5)	100.378(10)	
	H101	1.2545(6)	H61	1.8105(5)	121.27(2)	
	C8	1.6064(5)	H61	1.8105(5)	93.753(10)	
C11	N7	1.0038(3)	C6	1.2896(5)	55.242(16)	
	N7	1.0038(3)	C5	1.9947(6)	52.263(10)	
	C6	1.2896(5)	C5	1.9947(6)	36.350(9)	
H51	C5	2.0874(10)	C6	2.2979(7)	31.958(6)	
H61	C10	1.8105(5)	C8	2.4978(7)	39.921(7)	
H81	C8	1.3456(6)	N9	2.3316(10)	111.127(43)	
H101	C10	1.2545(6)	C8	2.2091(6)	45.664(8)	

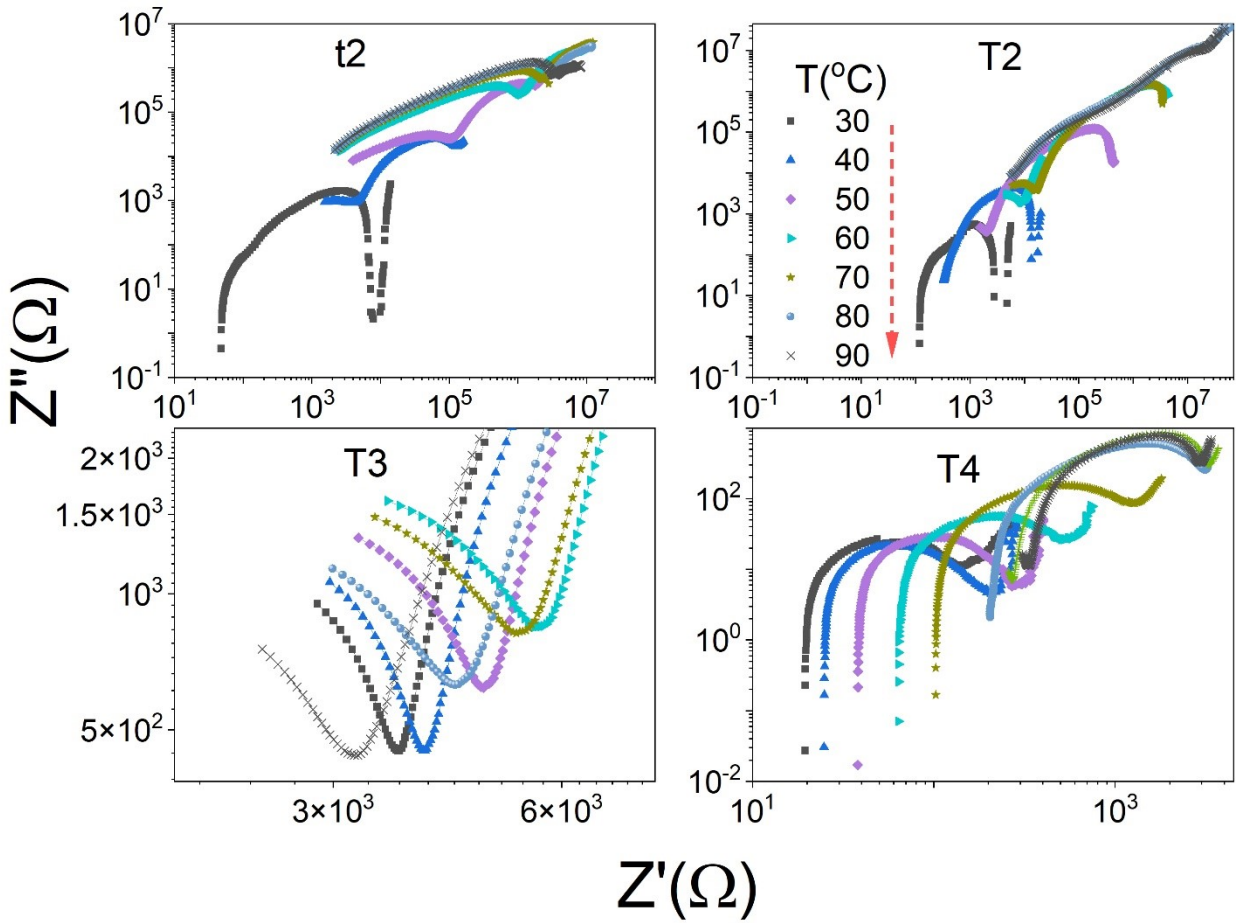


Figure S3 Impedance Nyquist plots in log-log representation with the variation of duration and temperature

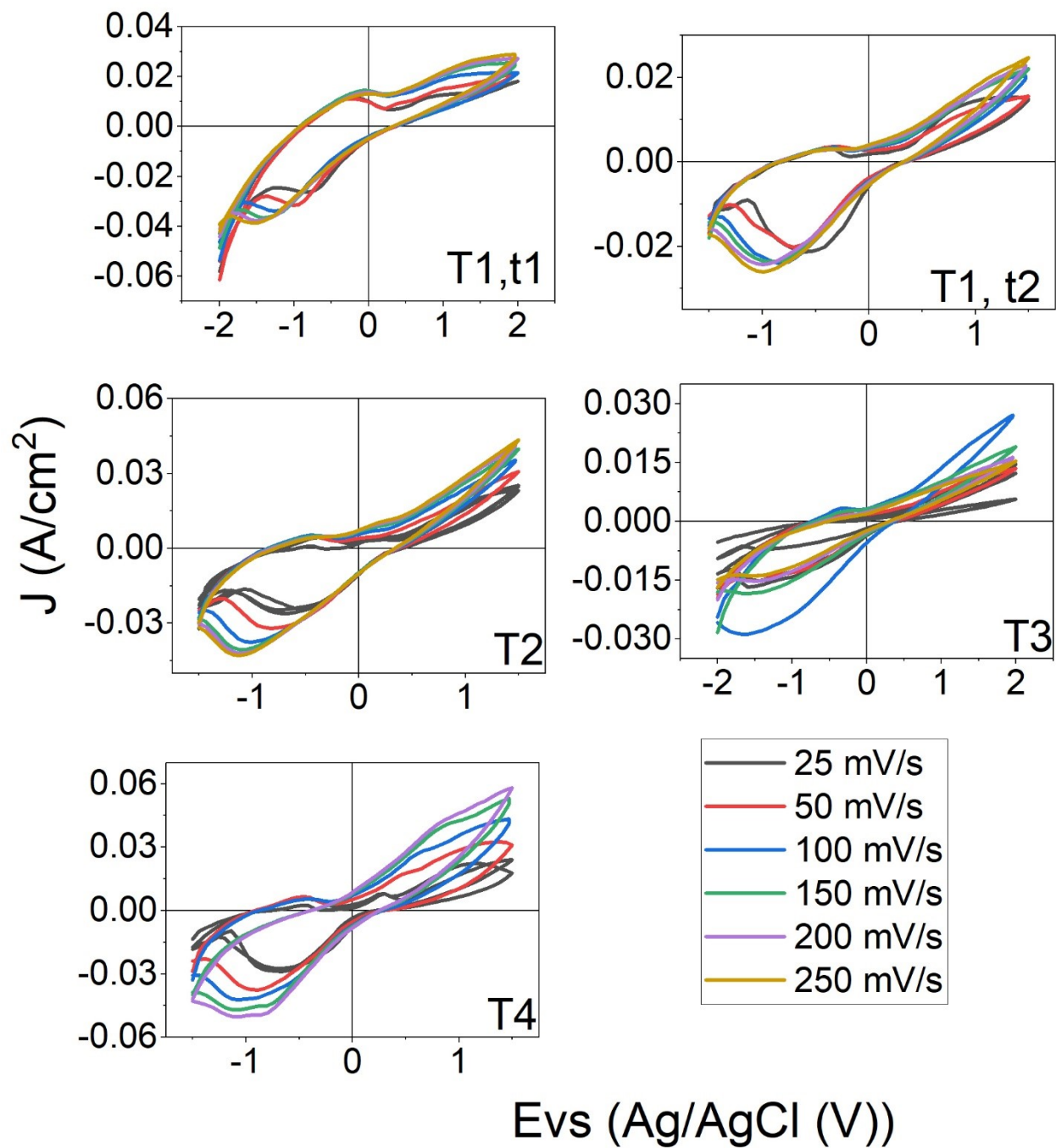


Figure S4 Cyclic voltammograms with the variation of scan rate for all the samples

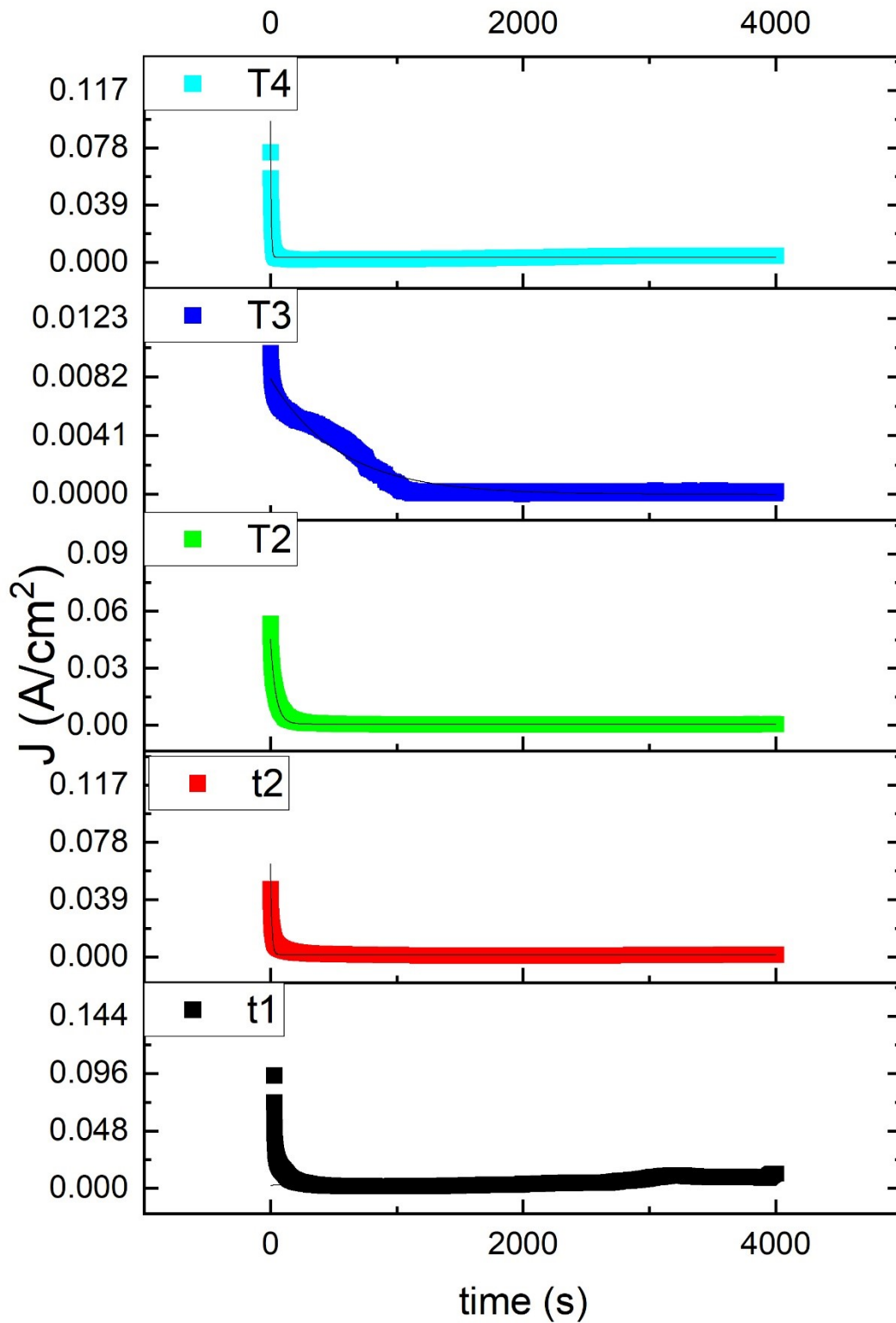


Fig. S5 Chronoamperometric curve of current density and time for all the samples

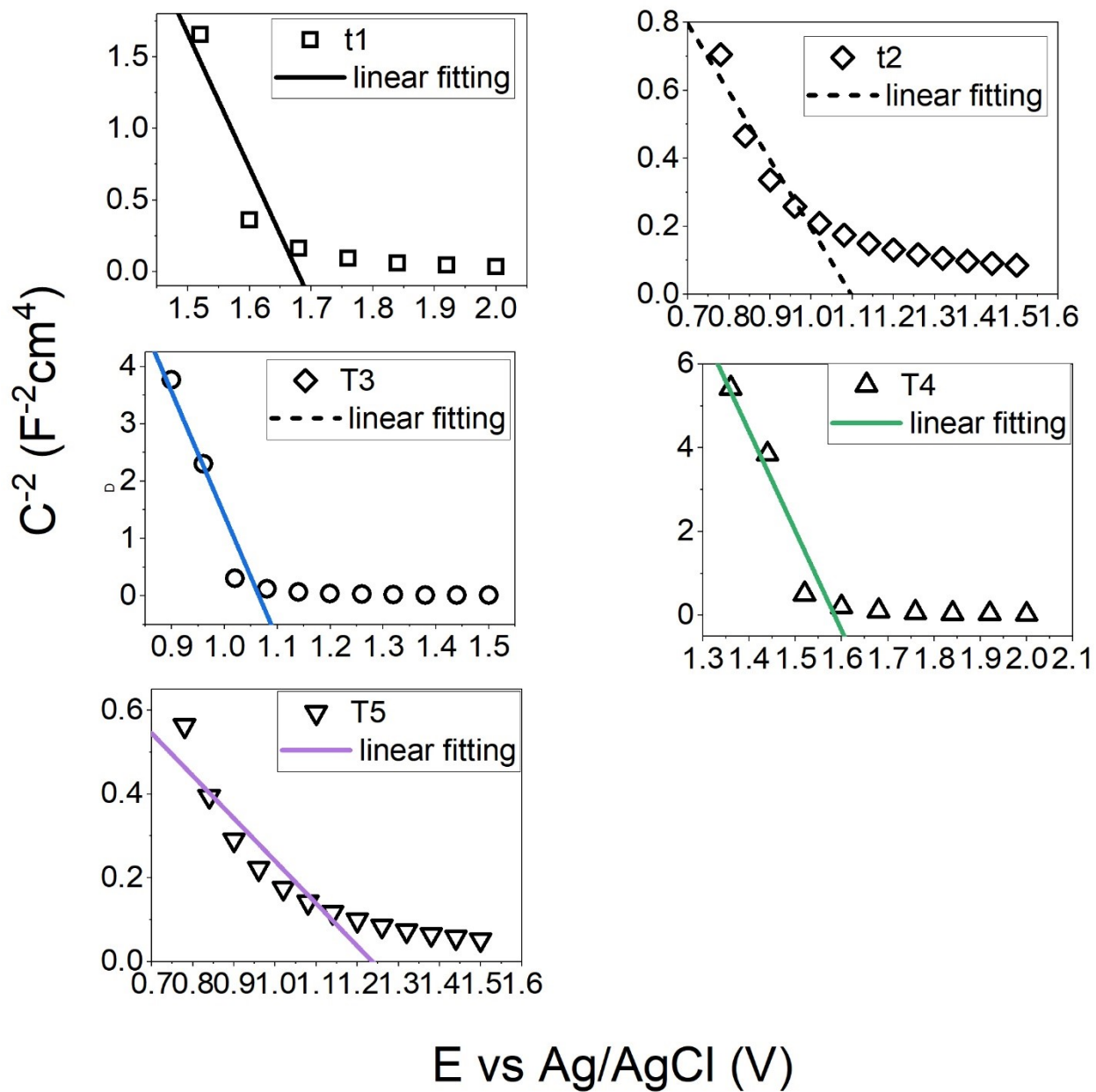


Fig. S6 Mott Schottky plots for all the membranes suggesting p-type semiconductor nature

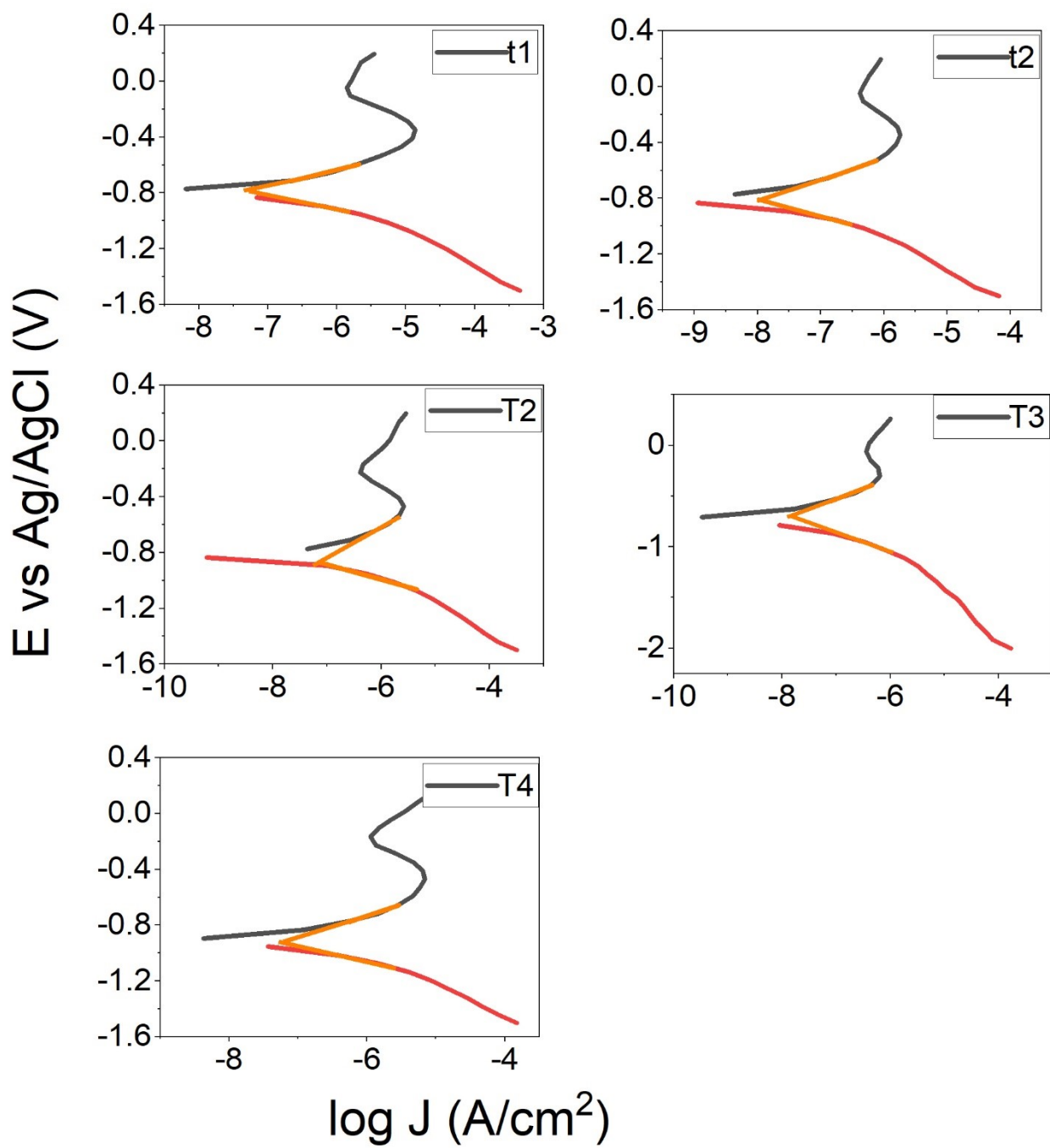


Fig. S7 Variation of $\log J$ vs E for all the films