Supporting Information (S.I):

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S.I. 2. ^{1}H NMR spectrum of Diiodo BIAN

S.I. 3. ^{1}H NMR spectrum of Diethynyl Fluorene

S.I. 4. ^{1}H NMR spectrum of BIAN-fluorene copolymer

S.I. 5. FTIR spectra of the monomers and BIAN-fluorene copolymer

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S.I. 7. Mass spectrum of Diethynylfluorene

S.I. 8. Mass spectrum of Diiodo BIAN

S.I. 9. Mass spectrum of Bis (trimethylsilylethynyl)-9,9-dioctyl-9H-fluorene

S.I. 10. GPC results for BF polymer

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S.I. 14. HOMO of BF from DFT calculations

S.I. 15. Scotch tape tests with PVDF and BF based electrodes

S.I. 16. Digital photographs showing interaction of the individual binder materials with 1:1 EC: DMC.

S.I. 17. FESEM images of a) pristine BF based electrodes, b) BF based electrodes after 100 cycles, c) pristine PVdF based electrodes, d) PVdF based electrodes after cycling

S.I. 18. Representative bode impedance spectrum showing the choice of different circuit elements

S.I. 19. DEIS Circuit fitting results for BF based binder during charging

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S.I. 21. DEIS Circuit fitting results for PVDF based binder during charging

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S.I. 23. Graphical representation of the equivalent circuit

S.I. 24. Digital photographs of the TiO_2 electrodes after drying.

S.I. 25. Comparison of discharge capacity of TiO_2 np's with BF and PVDF based binders at different current density

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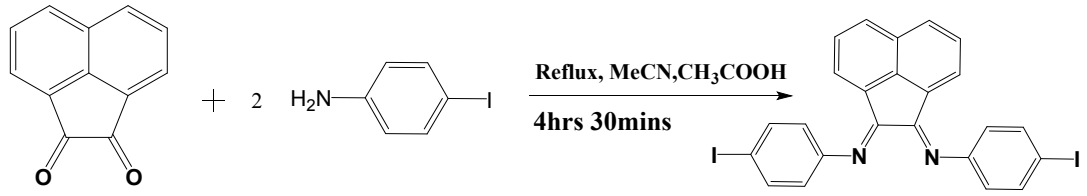
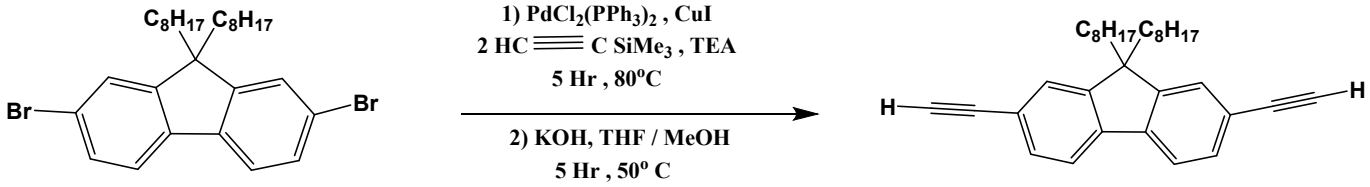
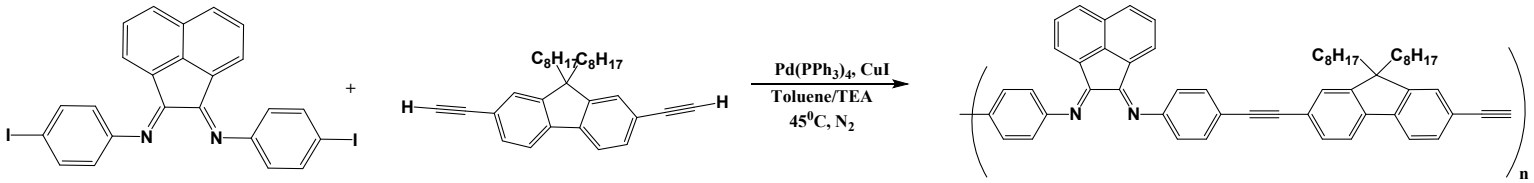


Acenaphthequinone **4-iodoaniline** **Diiodo BIAN**

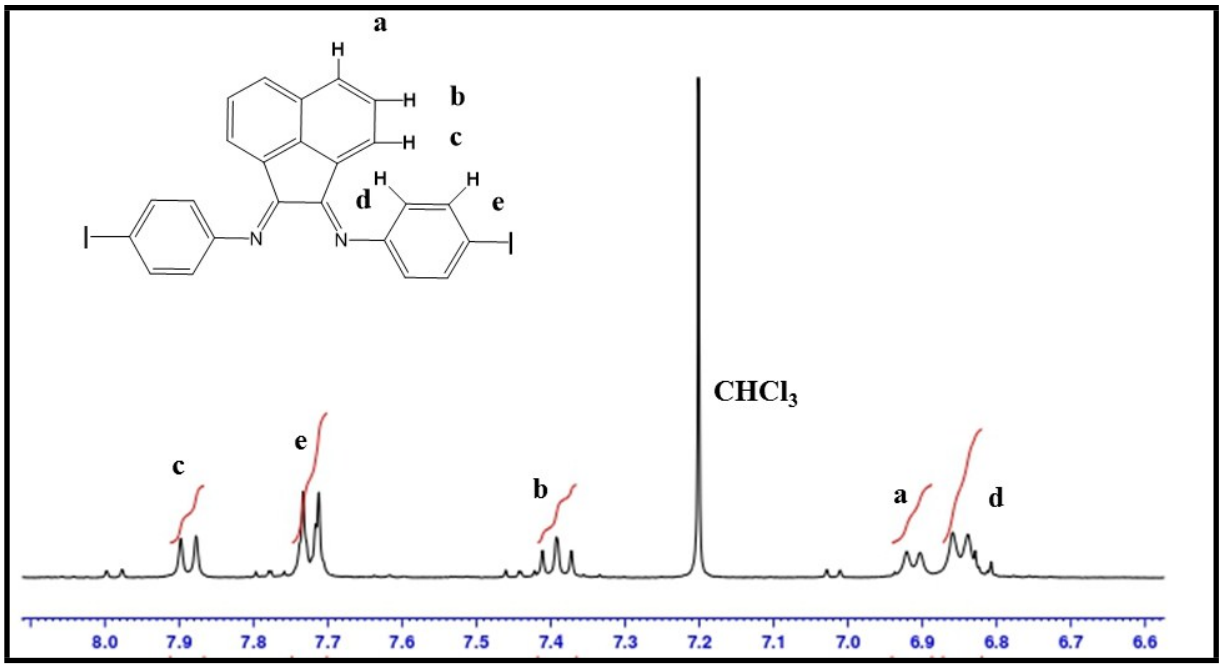


2,7-Dibromo-9,9-dioctyl-9H-fluorene **2,7-Diethynyl-9,9-dioctyl-9H-fluorene**

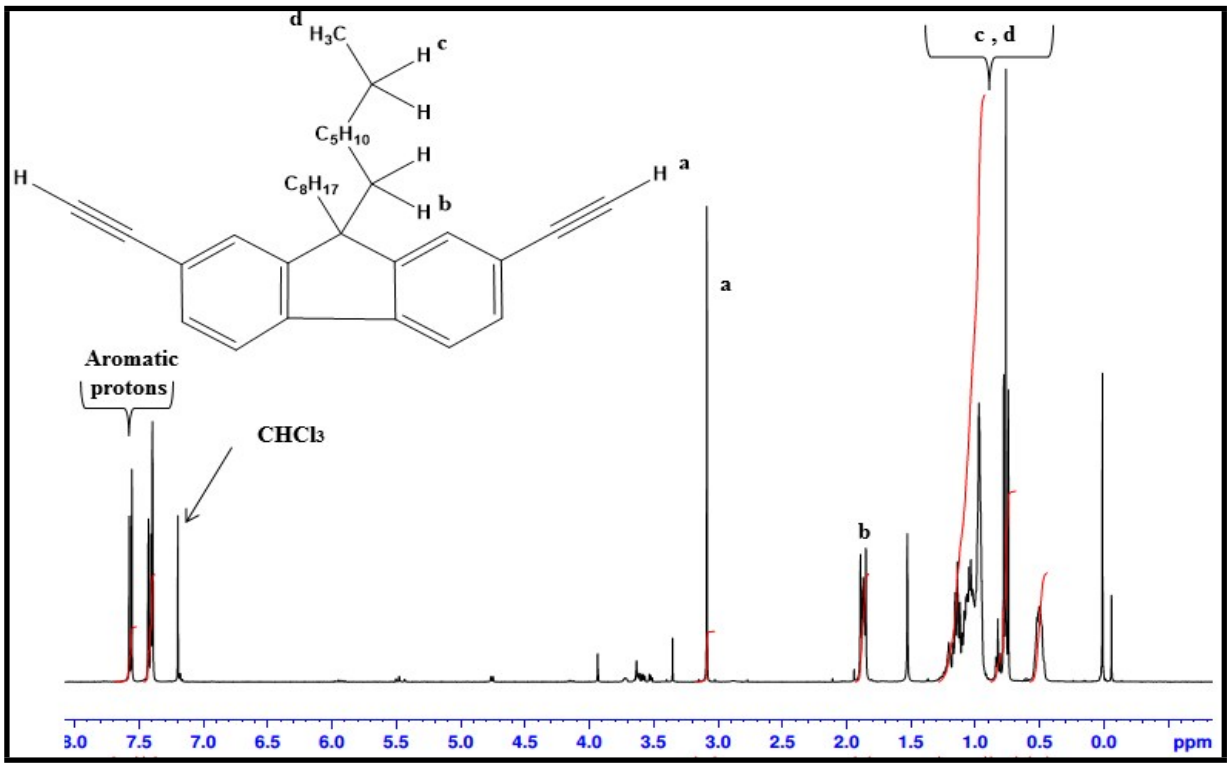


Diiodo BIAN **2,7-Diethynyl-9,9-dioctyl-9H-fluorene** **BIAN-Fluorene polymer**

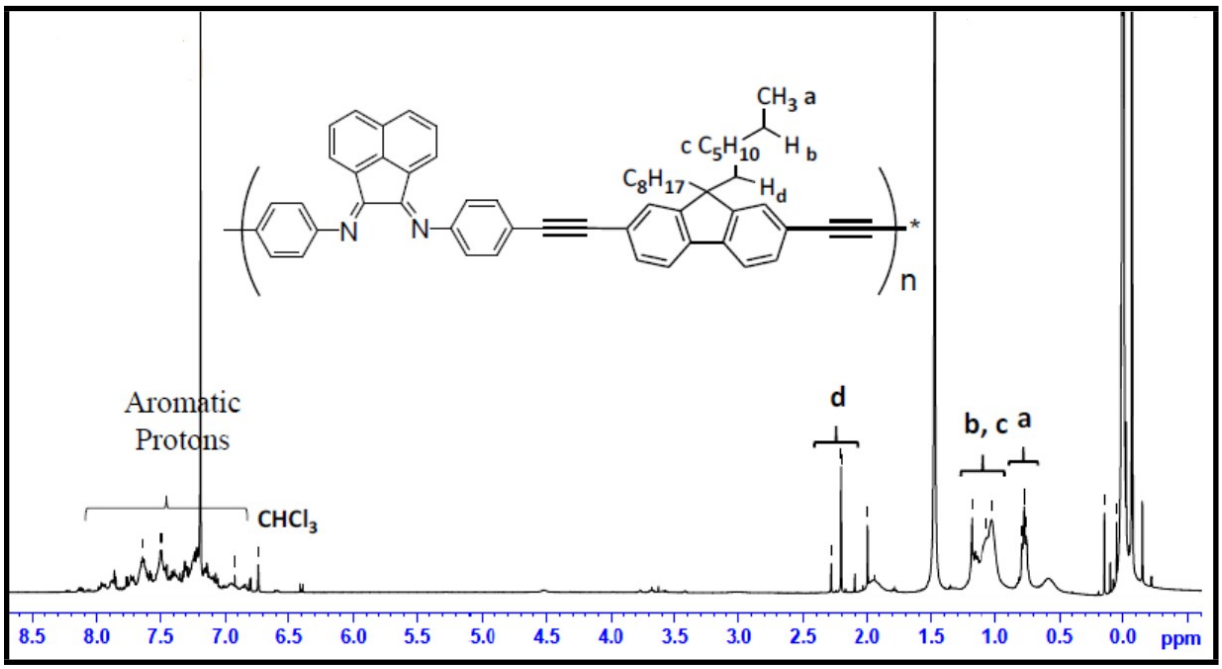
S.I. 1. Reaction scheme for synthesis of BF



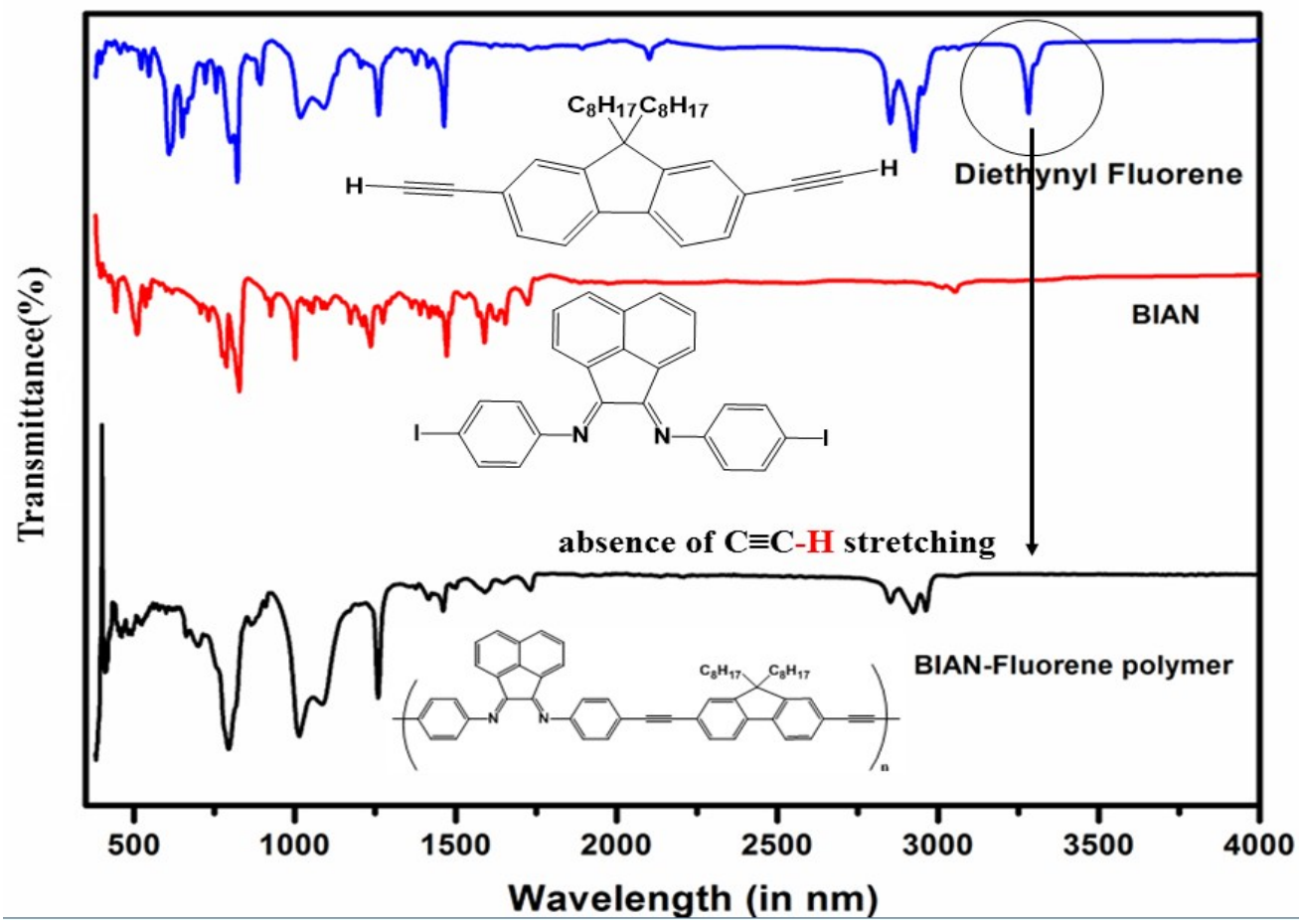
S.I. 2. ^{1}H NMR Spectra of Diiodo BIAN



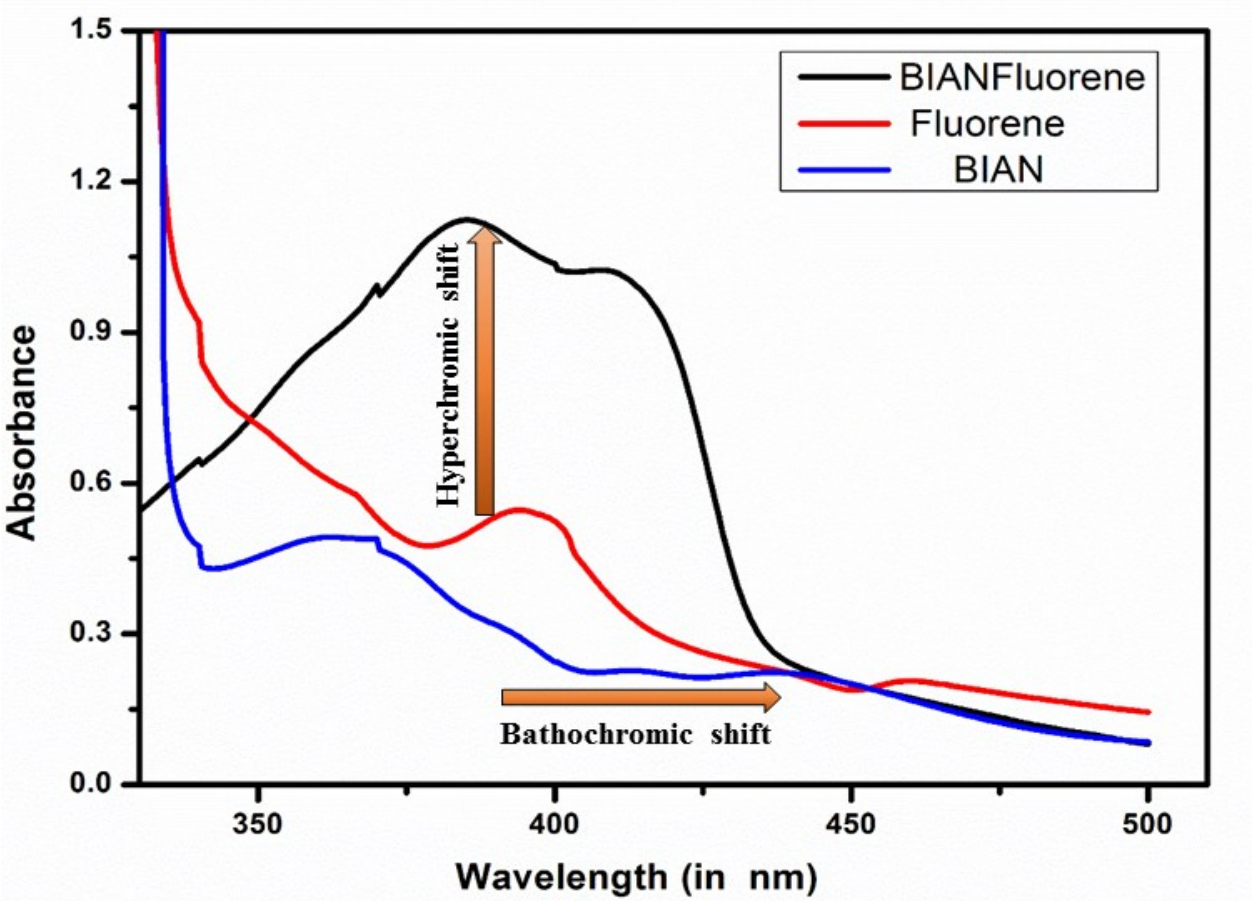
S.I. 3. ^{1}H NMR Spectra of Diethynyl Fluorene



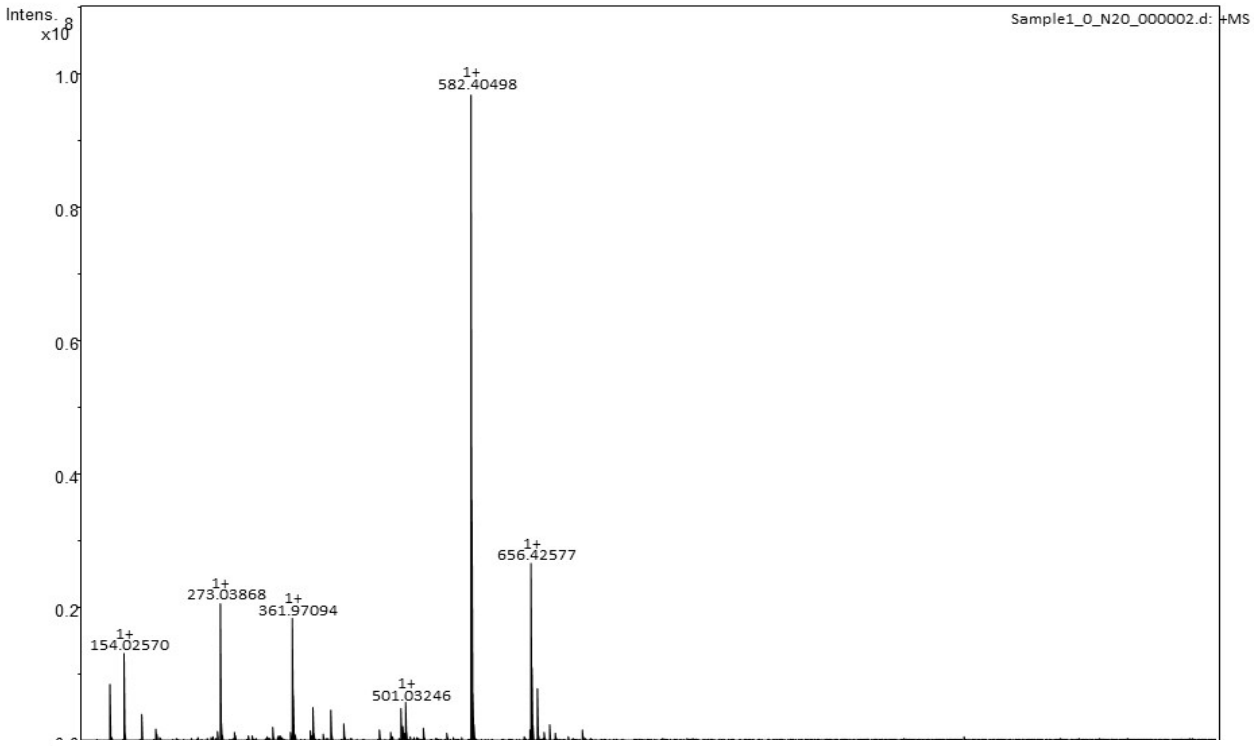
S.I. 4. ^{1}H NMR Spectra of BIAN-fluorene copolymer



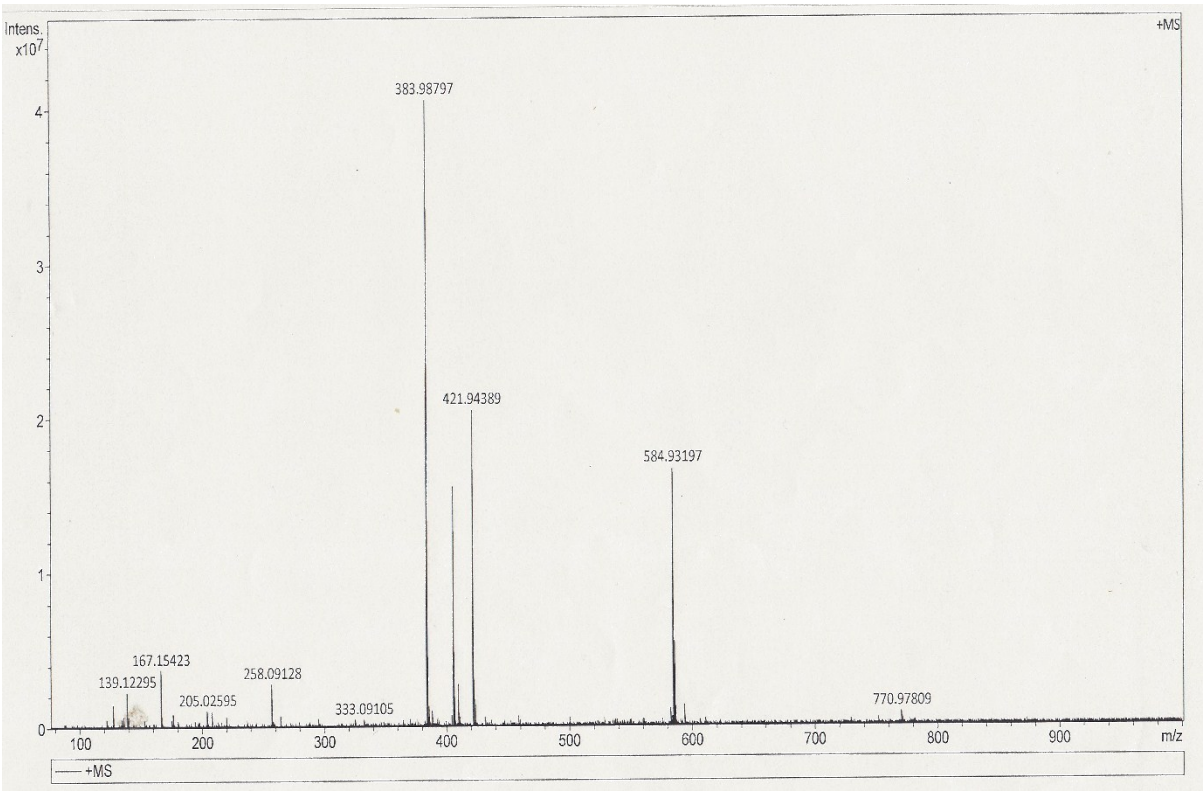
S.I. 5. FTIR spectra of the monomers and BIAN-fluorene copolymer



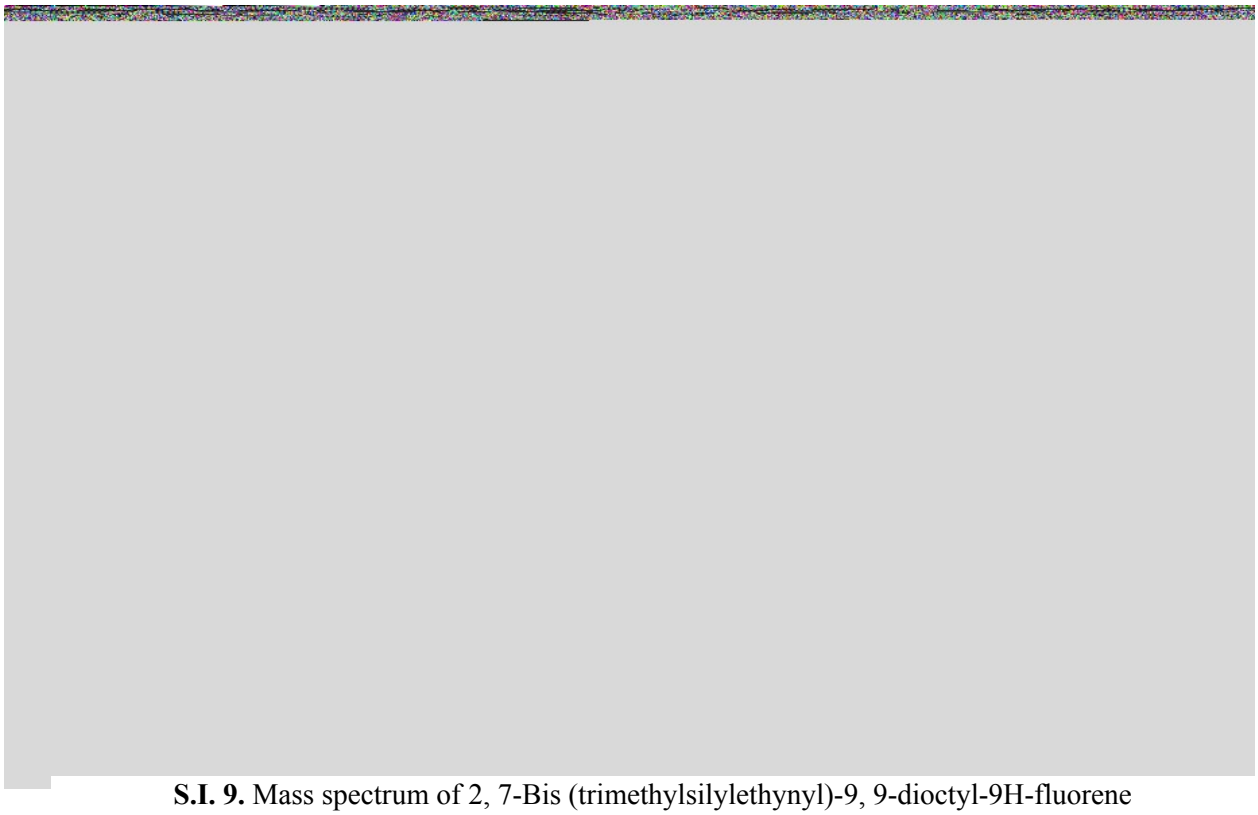
S.I. 6. UV-Vis spectra of the monomers and BIAN-fluorene copolymer



S.I. 7. Mass spectrum of Diethynyl Fluorene



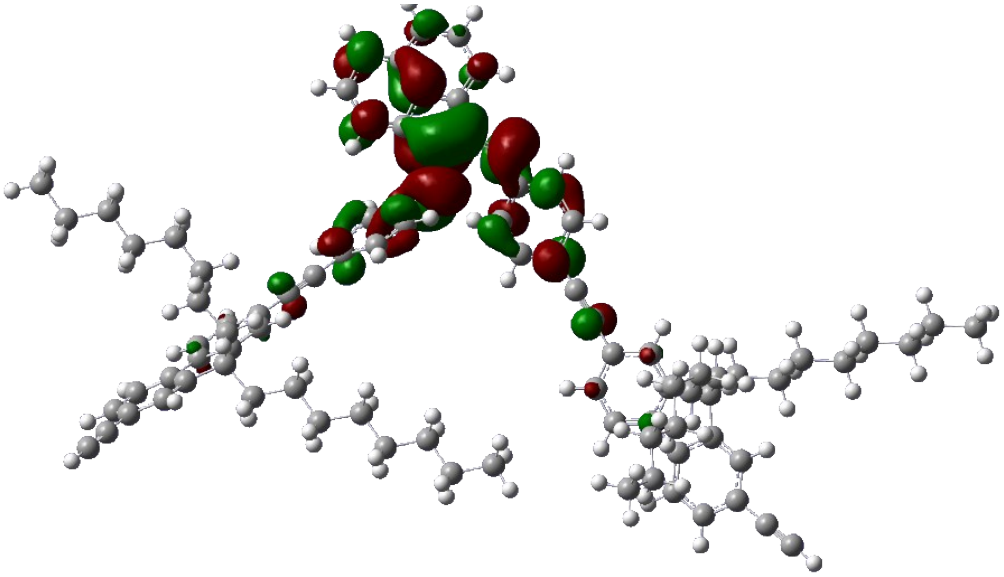
S.I. 8. Mass spectrum of Diiodo BIAN



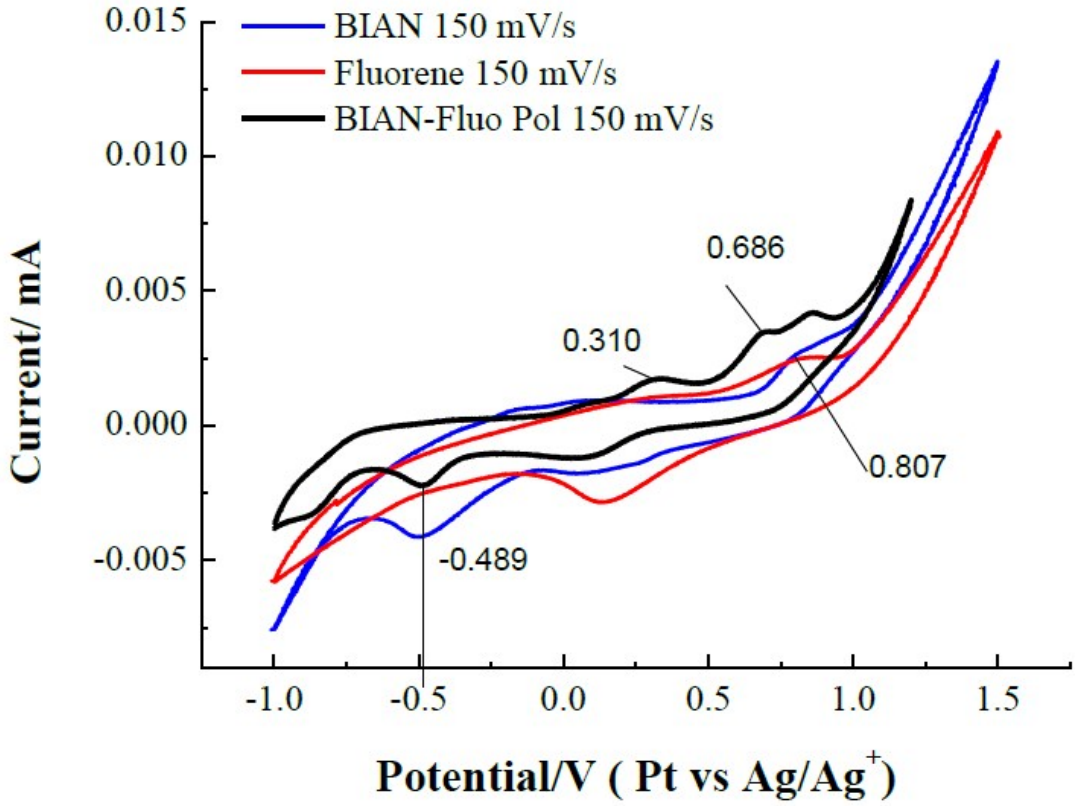
S.I. 9. Mass spectrum of 2, 7-Bis (trimethylsilylethynyl)-9, 9-dioctyl-9H-fluorene

Mn	Mw	Mz	Mw/Mn
40350	42301	43970	1.04

S.I. 10. GPC results for BF polymer

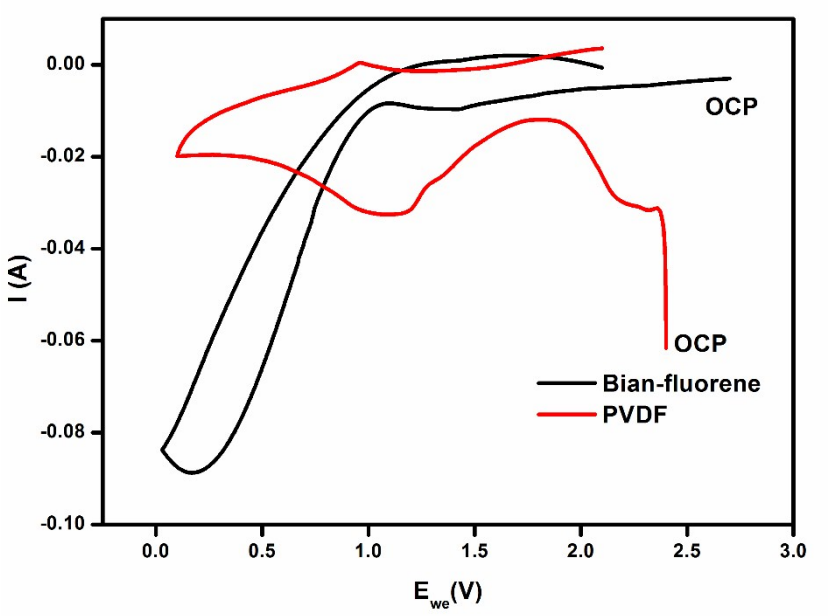


S.I. 11. LUMO of BF from DFT calculations

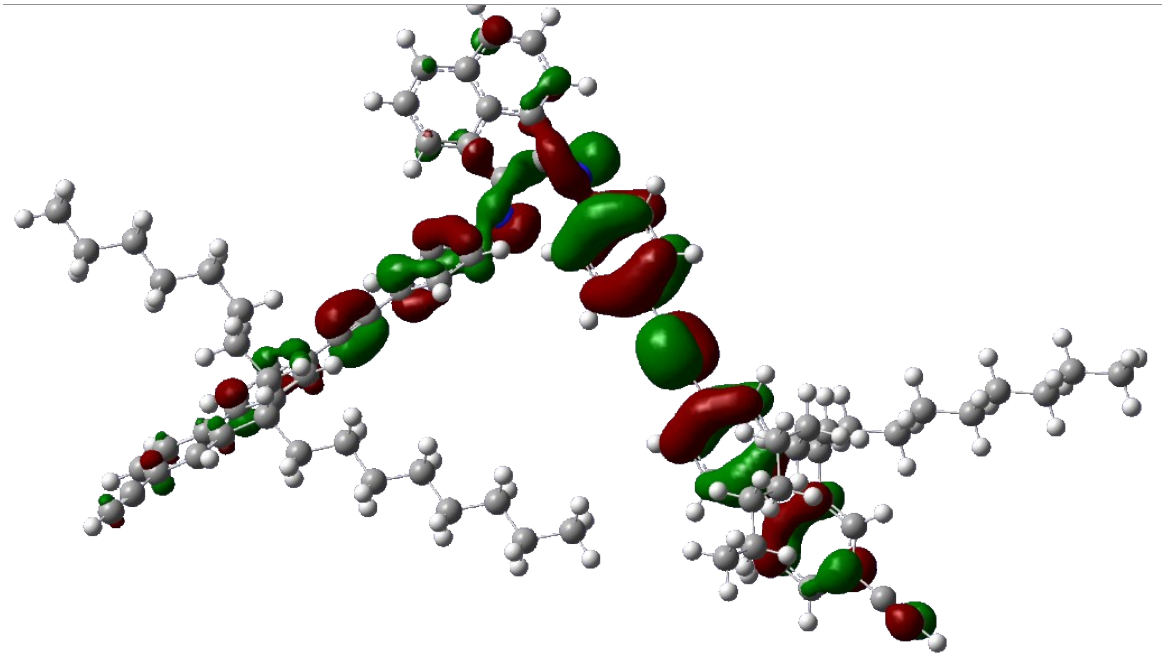


S.I. 12. Cyclic voltammograms of BIAN, Fluorene and BIAN-Fluorene polymer

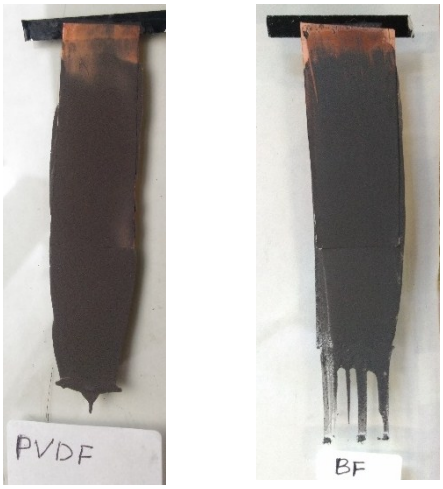
Now $E_{LUMO} = -e\,(E_{red}^{onset} + 4.4)$. In this case, $E_{LUMO} = -e\,(-0.47+4.4) = -3.93$ eV. This value of LUMO is further lower compared to the value obtained from DFT studies, and hence further supporting our hypothesis that it gets doped before degradation of EC based electrolytes.



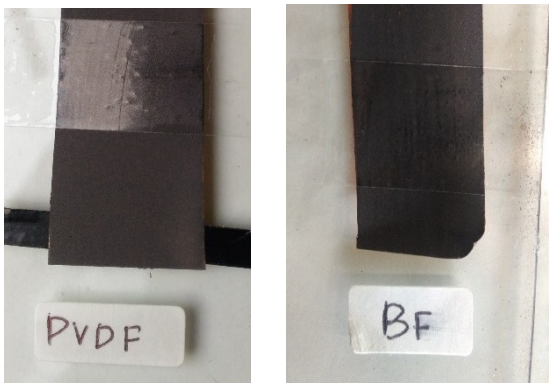
S.I. 13. First cycle cyclic voltammetry comparison of pure BF and PVDF polymer films only w.r.t Li in 1M LiTFSI /EC: DEC



S.I. 14. HOMO of BF from DFT calculations

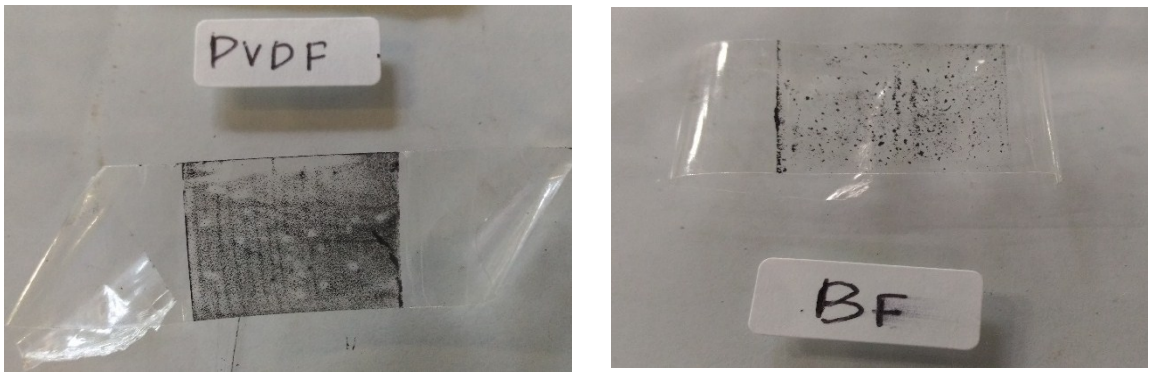


a) Digital photographs of electrodes with PVDF and BF after drying



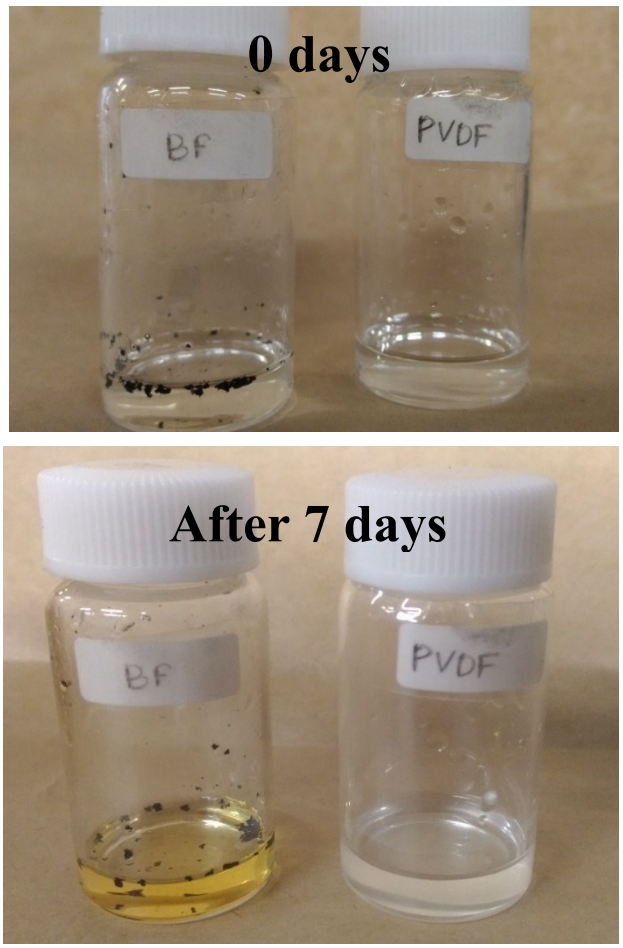
BF based electrodes showed 99.86% weight retention after peeling where as PVdF based electrodes

b) Digital photographs of electrodes with PVDF and BF with scotch tape



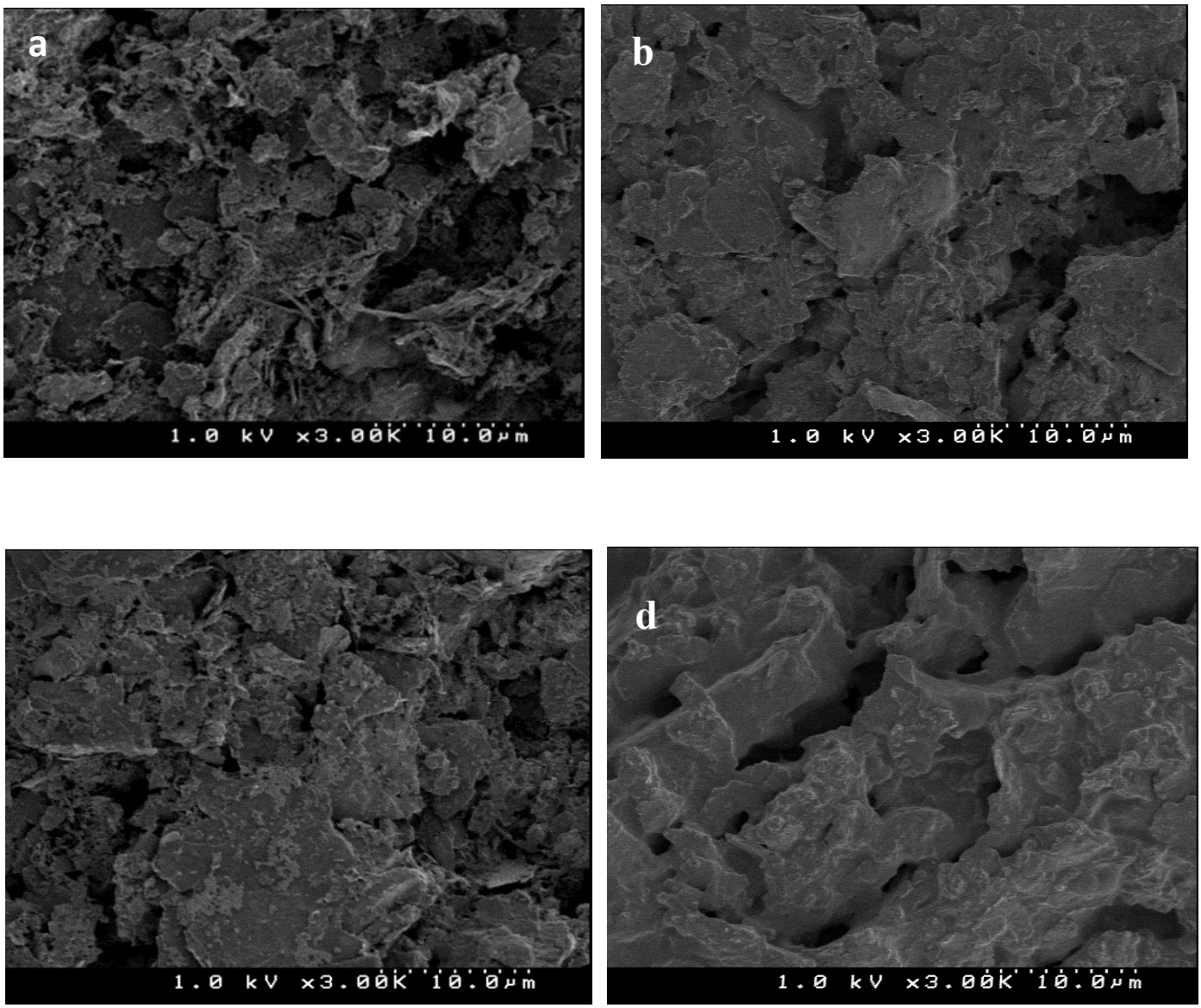
c) Digital photographs of scotch tape after tests with PVDF and BF

S.I. 15. Scotch tape tests with PVDF and BF based electrodes showed 99.64% weight retention after peeling.

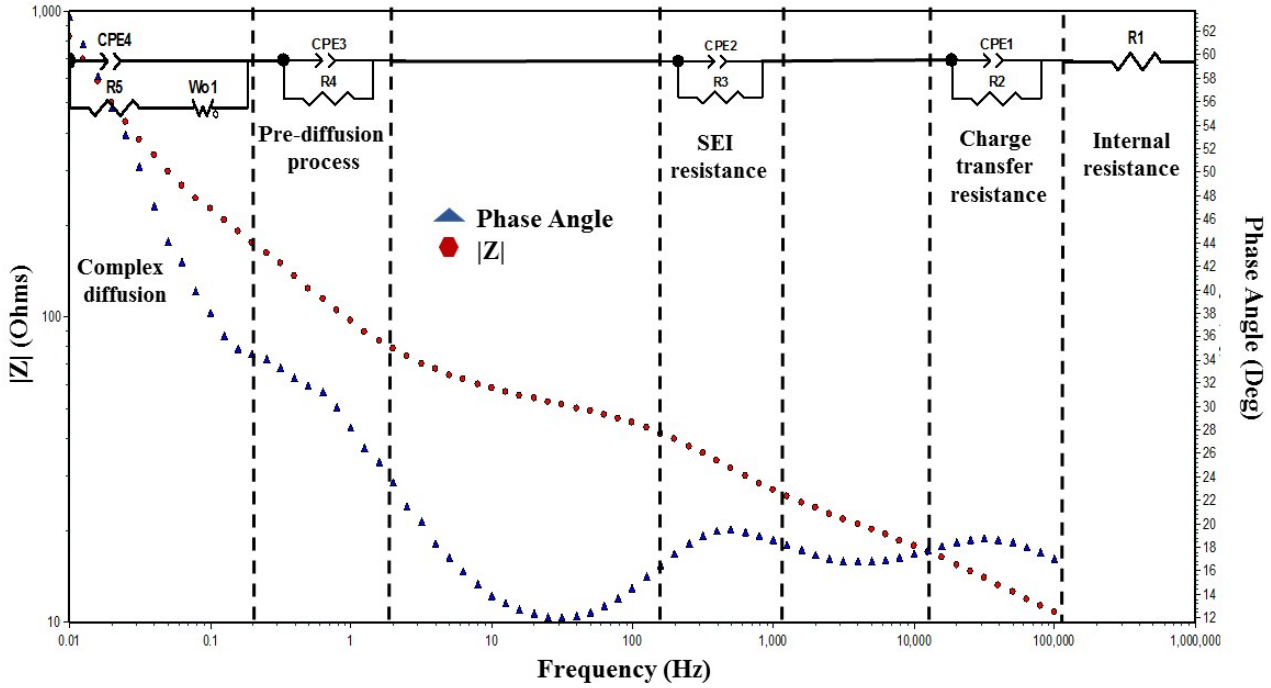


S.I. 16. Digital photographs showing interaction of the individual binder materials with 1:1 EC: DMC.

To see the wettability of the binder material in the electrolyte, we tried to dissolve 5mg of BF as well as PVdF in 2mL of 1:1 EC: DMC at room temperature. In case of BF, the polymer doesn't dissolve in the electrolyte even after sonication, whereas in case of PVdF, the polymer easily dissolved in the electrolyte on slight shaking. This can be seen from the attached video with the document. Even after seven days of ageing in the electrolyte solution, only very small amount of the polymer binder (mostly the low molecular weight fraction) dissolves in the electrolyte.



S.I. 17. FESEM images of a) pristine BF based electrodes, b) BF based electrodes after 100 cycles, c) pristine PVdF based electrodes, d)PVdF based electrodes after cycling



S.I. 18. Representative bode impedance spectrum showing the choice of different circuit elements

R1	R2	R3	R4	χ2	Circuit	Potential (V)
6.395	4.758	15.39	5.42E+01	2.03E-05	R(QR)(QR)(QR)(C(RW))	1.99
6.054	20.05	32.25	57.27	2.75E-05	R(QR)(QR)(QR)(Q(RW))	1.89
6.564	22.4	32.33	366.3	3.05E-05	R(QR)(QR)(QR)(Q(RW))	1.78
7.254	26.81	38.11	91.01	2.66E-05	R(QR)(QR)(QR)(Q(RW))	1.68
6.885	17.58	21.02	44.15	3.98E-05	R(QR)(QR)(QR)(C(RW))	1.57
7.3	7.461	28.4	48.57	3.48E-05	R(QR)(QR)(QR)(Q(RW))	1.48
6.241	21.09	36.5	1596	3.20E-05	R(QR)(QR)(QR)(Q(RW))	1.37
7.388	21.81	27.76	50.78	7.29E-05	R(QR)(QR)(QR)(Q(RW))	1.27
6.98	15.85	21.63	98.43	1.80E-04	R(QR)(CR)(CR)(Q(RW))	1.18
7.48	24.79	54.33	185.1	4.36E-05	R(QR)(QR)(QR)(Q(RW))	1.05
7.266	7.266	41.6	116.6	2.28E-05	R(QR)(QR)(QR)(Q(RW))	0.95
6.215	18.89	31.61	92.92	2.20E-05	R(QR)(QR)(QR)(Q(RW))	0.84
6.103	6.59	12.38	78.68	1.75E-05	R(QR)(QR)(QR)(C(RW))	0.74
7.497	20.67	63.82	135	4.75E-05	R(QR)(QR)(QR)(C(RW))	0.64
7.549	7.092	21.84	59.75	3.19E-05	R(QR)(QR)(QR)(Q(RW))	0.54
2.876	14.99	16.33	53.81	2.51E-05	R(QR)(QR)(QR)(Q(RW))	0.43
5.225	18.64	19.76	44.54	1.44E-05	R(QR)(QR)(QR)(Q(RW))	0.32

S.I. 19. DEIS Circuit fitting results for BF based binder during charging

R1	R2	R3	R4	χ2	Circuit	Potential(V)
7.253	6.5	13.69	25.49	4.80E-04	R(QR)(QR)(QR)(Q(RW))	0.32
6.858	5.776	15.56	22.95	3.69E-05	R(QR)(QR)(QR)(Q(RW))	0.43
6.783	8.249	12.78	26.5	1.85E-05	R(QR)(QR)(QR)(Q(RW))	0.54
4.018	1.711	12.58	4.44E+01	5.23E-05	R(CR)(QR)(QR)(Q(RW))	0.64
3.748	3.415	13.45	61	4.08E-05	R(QR)(QR)(QR)(Q(RW))	0.74
5.156	12.12	7.325	8.56E+01	1.56E-05	R(QR)(QR)(QR)(Q(RW))	0.84
6.77	15.87	23.84	93.71	2.27E-05	R(QR)(QR)(QR)(Q(RW))	0.95
4.102	3.155	9.25	1.52E+02	1.37E-04	R(QR)(QR)(Q(RC))(Q(RW))	1.05
4.102	7.321	13.76	28.43	3.78E-05	R(QR)(QR)(Q(RC))(Q(RW))	1.18
6.691	7.651	9.351	4.08E+01	8.02E-05	R(QR)(QR)(Q(RQ))(C(RW))	1.27
5.42	7.484	18.52	357.3	6.00E-05	R(QR)(QR)(QR)(Q(RW))	1.37
2.96	3.096	10.73	80.38	8.50E-05	R(QR)(QR)(CR)(Q(RW))	1.48
6.322	12.04	19.85	103.2	6.12E-05	R(QR)(QR)(QR)(Q(RW))	1.57
2.657	2.925	10.76	87.75	6.06E-05	R(CR)(QR)(QR)(Q(RW))	1.68
6.487	5.861	10.1	38.5	8.03E-05	R(QR)(CR)(QR)(Q(RW))	1.78
4.572	3.2	11.9	48.31	6.03E-05	R(QR)(QR)(QR)(C(RW))	1.89
3.869	2.431	14.94	39.34	1.93E-04	R(QR)(QR)(QR)(C(RW))	1.99

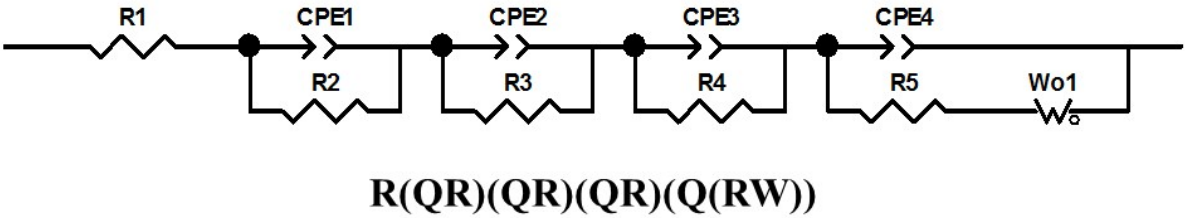
S.I. 20. DEIS Circuit fitting results for BF based binder during discharging

R1	R2	R3	R4	χ2	Circuit	Potential(V)
8.603	16.13	28.32	100.7	5.20E-05	R(QR)(QR)(QR)(Q(RW))	1.99
8.332	15.32	96.64	1018	3.62E-05	R(QR)(QR)(QR)(Q(RW))	1.89
7.899	14.06	78.1	787.3	2.81E-05	R(QR)(QR)(QR)(Q(RW))	1.78
7.645	13.02	74.07	1227	2.58E-05	R(QR)(QR)(QR)(Q(RW))	1.68
7.358	10.87	73.15	1033	2.16E-05	R(QR)(QR)(QR)(Q(RW))	1.57
7.315	9.659	17.49	73.26	5.35E-05	R(QR)(CR)(QR)(Q(RW))	1.48
7.089	10.24	57.18	71.85	3.16E-05	R(QR)(QR)(QR)(Q(RW))	1.37
7.236	9.213	70.84	961.1	2.28E-05	R(QR)(QR)(QR)(Q(RW))	1.27
7.057	9.426	30.13	39.93	2.32E-05	R(QR)(QR)(CR)(Q(RW))	1.18
7.012	9.463	69.76	655.9	2.24E-05	R(QR)(QR)(QR)(Q(RW))	1.05
7.07	8.873	66.3	380.8	2.10E-05	R(QR)(QR)(QR)(C(RW))	0.95
6.941	7.599	63.23	101.9	2.00E-05	R(QR)(QR)(QR)(Q(RW))	0.84
6.847	7.052	48.16	64.94	1.65E-05	R(QR)(QR)(QR)(Q(RW))	0.74
6.764	6.897	68.95	71.58	1.79E-05	R(QR)(QR)(QR)(C(RW))	0.64
6.659	8.034	54.94	68.95	1.47E-05	R(QR)(QR)(QR)(Q(RW))	0.54
6.159	9.26	16.02	67.72	1.48E-05	R(QR)(QR)(QR)(Q(RW))	0.43
5.451	10.84	64.62	2111	1.42E-05	R(QR)(QR)(QR)(Q(RW))	0.32

S.I. 21. DEIS Circuit fitting results for PVDF based binder during charging

R1	R2	R3	R4	$\chi 2$	Circuit	Potential(V)
6.598	6.453	31.22	770.7	2.40E-05	R(QR)(QR)(QR)(C(RW))	0.32
6.631	6.882	32.12	4.01E+01	1.69E-05	R(QR)(QR)(QR)(C(RW))	0.43
5.35	21.3	30.42	4.62E+01	2.30E-05	R(QR)(QR)(QR)(C(RW))	0.54
5.862	21.21	39	5.08E+02	1.41E-04	R(QR)(QR)(QR)(C(RW))	0.64
5.187	23.49	128.1	393.3	5.86E-05	R(QR)(QR)(QR)(C(RW))	0.74
6.824	20.47	23.88	132.8	1.84E-05	R(QR)(QR)(QR)(Q(RW))	0.84
6.499	10.21	29.23	179.1	1.78E-05	R(QR)(QR)(QR)(Q(RW))	0.95
6.858	8.65	30.89	280.2	2.09E-05	R(QR)(QR)(QR)(Q(RW))	1.05
6.777	8.991	17.23	29.74	2.57E-05	R(QR)(QR)(QR)(Q(RW))	1.18
6.496	12.55	13.6	13.42	7.49E-05	R(QR)(CR)(CR)(Q(RW))	1.27
7.052	8.93	11.99	32.81	5.36E-05	R(QR)(QR)(QR)(C(RW))	1.37
7.057	9.337	32.65	635.2	2.18E-05	R(QR)(QR)(QR)(Q(RW))	1.48
7.13	9.43	34.29	55.3	3.50E-05	R(QR)(QR)(QR)(Q(RW))	1.57
7.142	9.985	33.53	71.73	2.29E-05	R(QR)(QR)(QR)(C(RW))	1.68
7.111	10.9	33.31	736.4	3.87E-05	R(QR)(QR)(QR)(Q(RW))	1.78
7	6.624	17.26	27.36	1.65E+04	R(QR)(QR)(QR)(C(RW))	1.89
7.444	13.32	14.51	3.47E+01	6.20E-05	R(QR)(QR)(QR)(Q(RW))	1.99

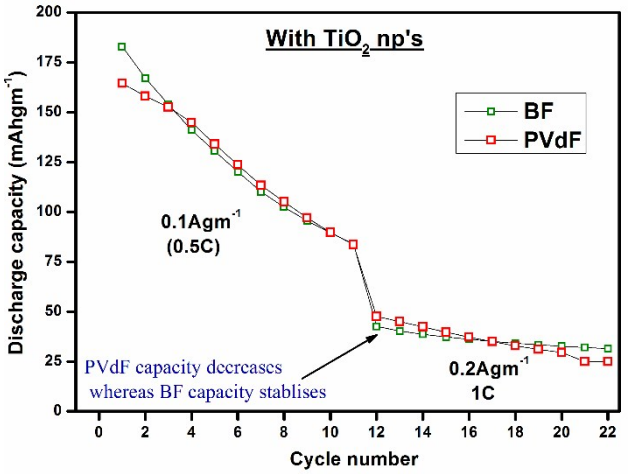
S.I. 22. DEIS Circuit fitting results for PVDF based binder during discharging



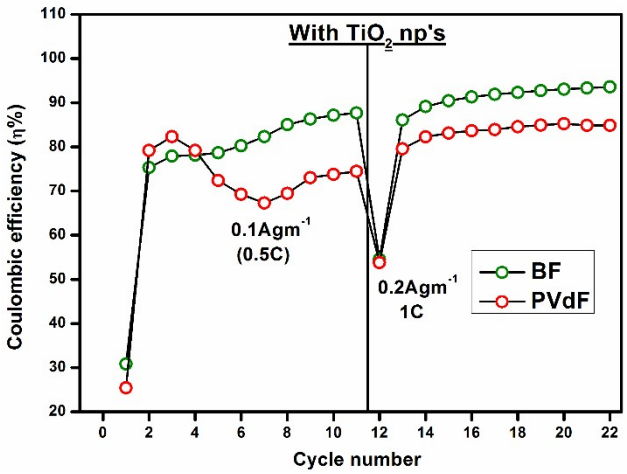
R(QR)(QR)(QR)(Q(RW))

S.I. 23. Graphical representation of the equivalent circuit

S.I. 24. Digital photographs of the TiO_2 electrodes after drying.



S.I. 25. Comparison of discharge capacity of TiO_2 np's with BF and PVdF based binders at different current densities



S.I. 26. Comparison of Coulombic efficiency of TiO_2 np's with BF and PVdF based binders at different current density