Supporting Information

Organic Thin Paper of Cellulose Nanofiber/Polyaniline Doped with (±)-10-Camphorsulfonic Acid Nanohybrid and its Application to Electromagnetic Shielding

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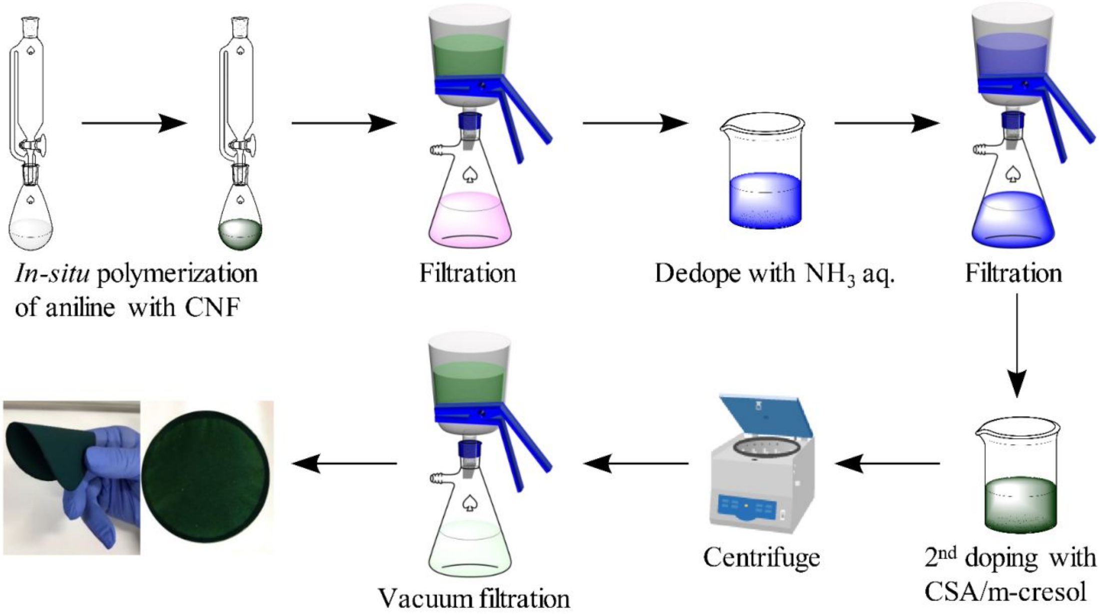

Figure. S1. Fabrication processes of PANI-CSA coated CNF paper.

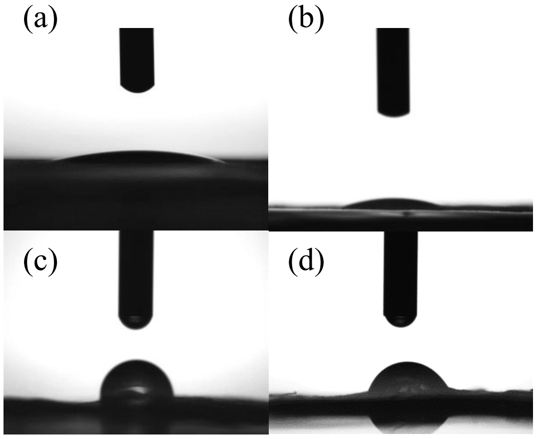

Table S1. Contact angle values of pristine CNF, modified CNF with PANI-Cl, PANI and PANI-CSA

Sample	Contact angle (°)
pristine CNF	12.1±2.4
PANI-Cl coated CNF	19.0±5.5
PANI coated CNF	69.9±10.5
PANI-CSA coated CNF	70.4±9.8

Figure. S2. Images of contact angle value of modified CNF to water droplet of (a)freeze-dry CNF, (b)PANI-Cl coated CNF, (c)dedoped-PANI coated CNF, (d)PANI-CSA coated CNF

Table S2. Assignments of the main peaks in the FTIR spectra of CNF, PANI(-Cl, -CSA) and PANI(-Cl, -CSA) coated CNF.

Peak assignments	Wavenumber / cm^{-1}						
	CNF	PANI			PANI coated CNF		
		-Cl	-	-CSA	-Cl	-	-CSA
-OH stretching 1.	3340				3430	3348	3400
-CH stretching 1.	2890				2900	2890	2890
-CH2 stretching 1.	1640				1600	1645	1660
-OCH in-plane bending 2.	1430				1438	1433	1410
-CH bending 2.	1370				-	1368	-
C-O-C asymmetric stretching 1.	1160				1150	1165	1160
C-O-C stretching 2.	1030				1040	1035	1130
vibration of anomeric carbon (C1) 2.	893				883	897	883
N-H stretching 2.	-	3000-3500			3000-3500		
C=O stretching vibration of dopant CSA 3.	-	-	-	1730	-	-	1730
C=C stretching vibration of quinoid ring (N=Q=N) 3.4.	-	1550	1591	1560	1550	1592	1560
C=C stretching vibration benzenoid ring (N-B-N) 3.4.	-	1470	1500	1480	1470	1510	1470
C-N stretching of secondary amine 1.	-	1290	1308	1300	1290	1315	1290

C-N+ in the polaron lattice 5.	-	1240	1244	1240	1240	1239	1240
C-H bending of quinoid ring (N=Q=N) 5. 6.	-	1130	1109	1140	1120	1109	1130
C − H bending at C1 and C4 of the benzene ring 1.	-	795	826	802	798	826	802

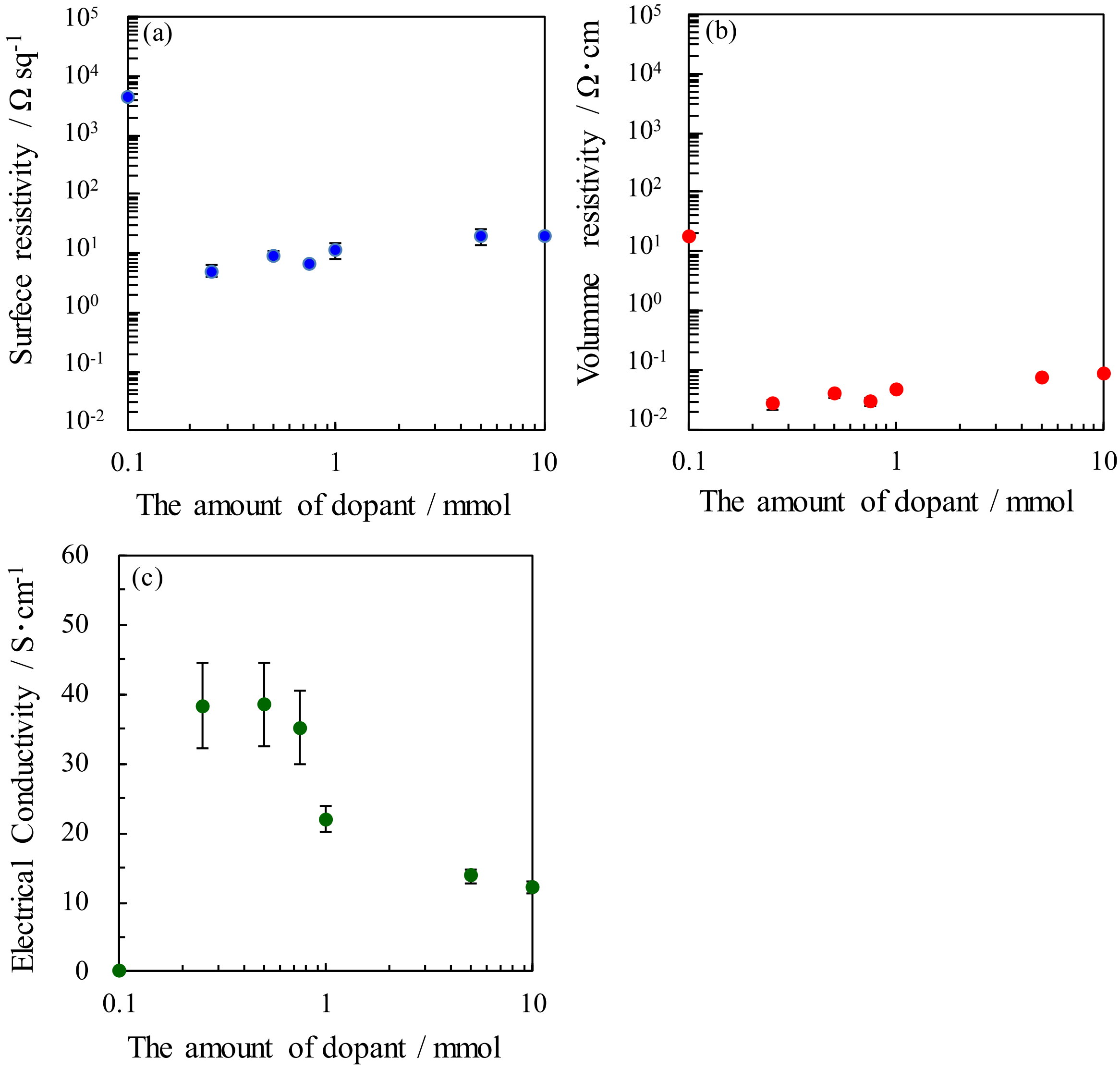

Figure. S3. Effect of the dopant amount on electrical properties of PANI-CSA coated CNF, (a) surface resistivity, (b) volume resistivity and (c) electrical conductivity.

Table S3. Summary of NCs and polyaniline hybrids conductivity

No.	NCs Substrate	Conductive Materials	Method	Conductivity (S/cm)	Refs.
1	BC	PANI-Cl	*In-situ* polymerization	2.5×10^{-2}	47
2	BC	PANI-Cl	*In-situ* polymerization	0.9	60
3	BC	PANI-DBSA	*In-situ* polymerization	1.61×10^{-4}	61
4	CNF	PANI-Cl	*In-situ* polymerization	0.075	42
5	CNF	PANI-Cl	*In-situ* polymerization	3.38	62
6	CNF	PANI-DBSA	*In-situ* polymerization	0.1	63
7	CNF	PANI-Cl	*In-situ* polymerization	0.314	40
8	CNF	PANI-Cl	*In-situ* polymerization	0.20	This work
9	CNF	PANI-CSA	*In-situ* polymerization	38.5	This work

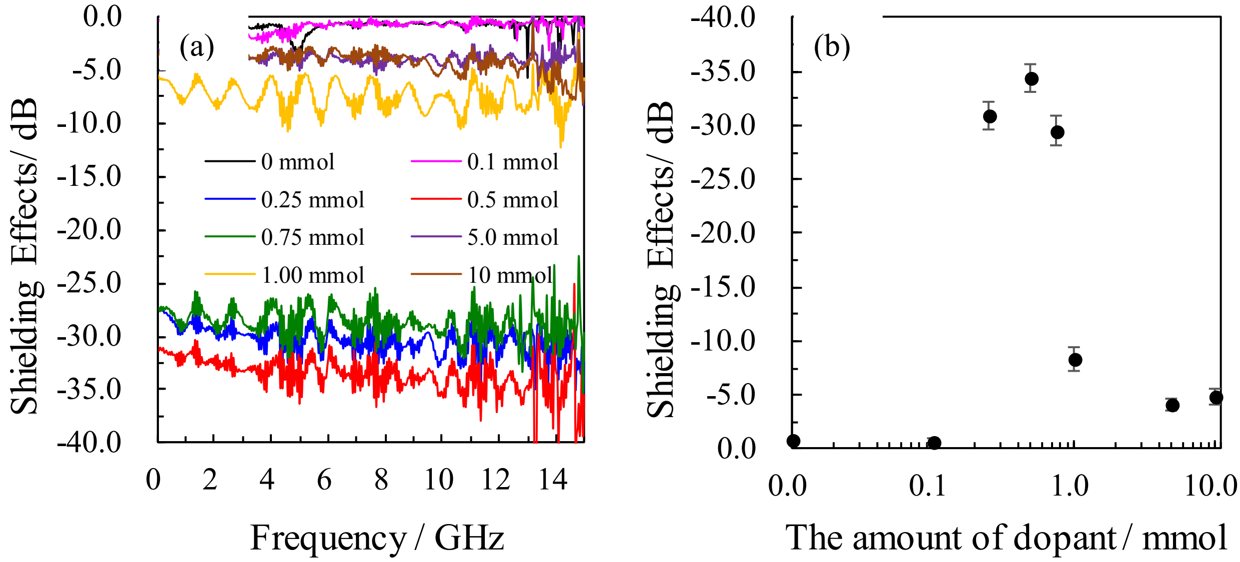

Figure. S4. Effect of dopant amount on EMS properties of PANI-CSA coated CNF (a) and its value at 10GHz (b)