Supplementary Information

Easily Fabricated and Lightweight PPy/PDA/AgNW Composites for Excellent Electromagnetic Interference Shielding

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Table S1 Thickness, density, AgNW volume fraction, electrical conductivity and skin depth of PPy/PDA/AgNW composite with different AgNW loading degree

AgNW loading degree (wt.%)	thickness (μm)	density (g/cm^3)	AgNW volume fraction (vol %)	electrical conductivity (S/cm)	skin depth (μm)
0	73.2	0.289	0	0.0108	5404
1	73.6	0.290	0.00028	0.0180	4199
3	74.5	0.292	0.00084	0.0191	4068
5	77.5	0.287	0.0014	0.0217	3817
10	84.7	0.277	0.0026	0.0291	3299
12	85.3	0.283	0.0032	0.03528	2995
14	87.9	0.279	0.0037	0.05456	2409
16	90.7	0.281	0.0043	0.10763	1715
20	95.1	0.278	0.0053	54.77	76.04
25	97.6	0.288	0.0069	263.39	34.67
30	102.9	0.293	0.0084	424.19	27.32
35	108.8	0.311	0.0099	578.06	23.40
40	115.8	0.304	0.0116	1035.44	17.49
45	120.3	0.317	0.0137	1140.27	16.67
50	127.1	0.332	0.0158	1206.72	16.20

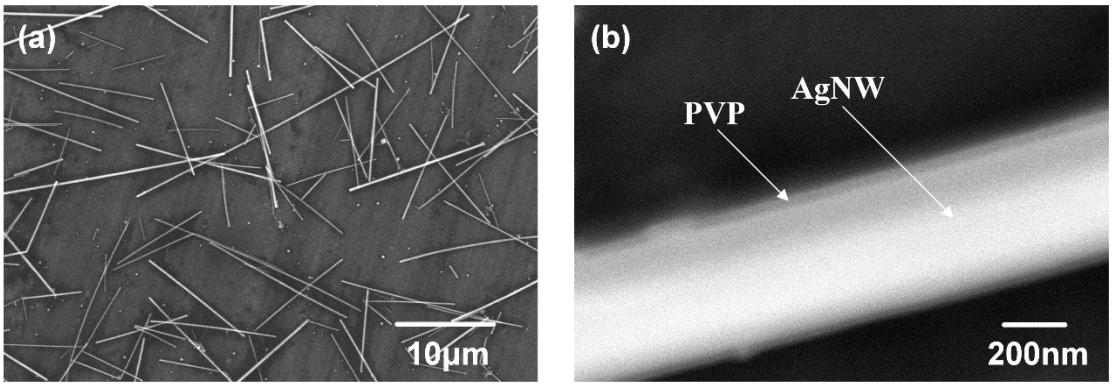

Fig. S1 SEM images of AgNW with different magnification: (a) ×2000, (b) ×70000.

From the images, the length and diameter of AgNW are evaluated to be 15.2±6.8 μm and 0.365±0.035 μm, respectively.

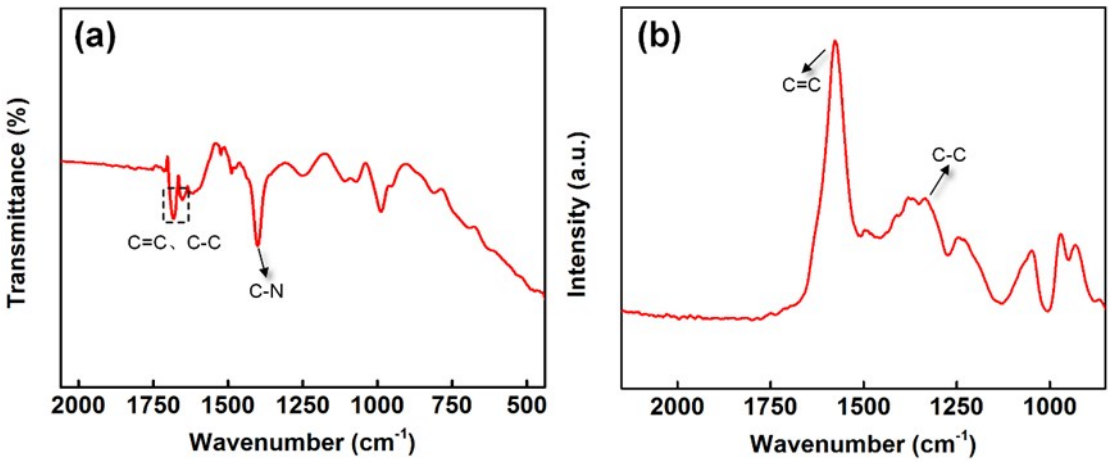

Fig. S2 (a) FT-IR and (b) Raman spectra of pure PPy.

The characteristic signal of pure PPy can be found from spectra above. In the FT-IR spectrum, the C-N stretching is found at 1428 cm^{-1}, and the band at around 1635 cm^{-1} can be attributed to C=C and C-C in pyrrole ring-stretching.[1] In the Raman spectrum, the C=C and C-C stretching vibration are merged into peaks at 1591 cm^{-1} and 1376 cm^{-1}.[2]

Fig. S3 The experiment setup (Vector network analyzer and waveguide sample holder) for EMI shielding measurement (S-parameters).

Vector network analyzer directly gives the output in form of four scattering parameters (S11, S12, S21, S22). The samples were cut into a rectangular shape, slightly larger in dimension (24 × 12 mm^2) as compared to the opening of the sample holder (22.84 × 10.14 mm^2).

About S-parameters:

The reflection (R) and transmission (T) coefficients were obtained from the network analyzer inform of scattering parameters, “Smn”, which measure how energy is scattered from a material or device. The first letter “m” designate the network analyzer port receiving the EMI radiation and the second letter “n”, represents the port that is transmitting the incident energy.

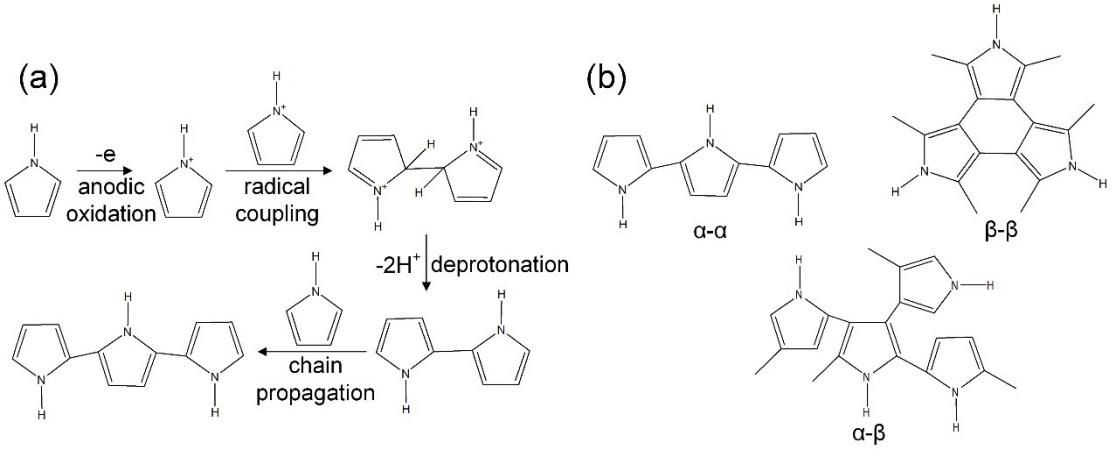

Fig. S4 (a) a possible polymerization mechanism of polypyrrole (PPy), (b) three basic modes of PPy polymerization.

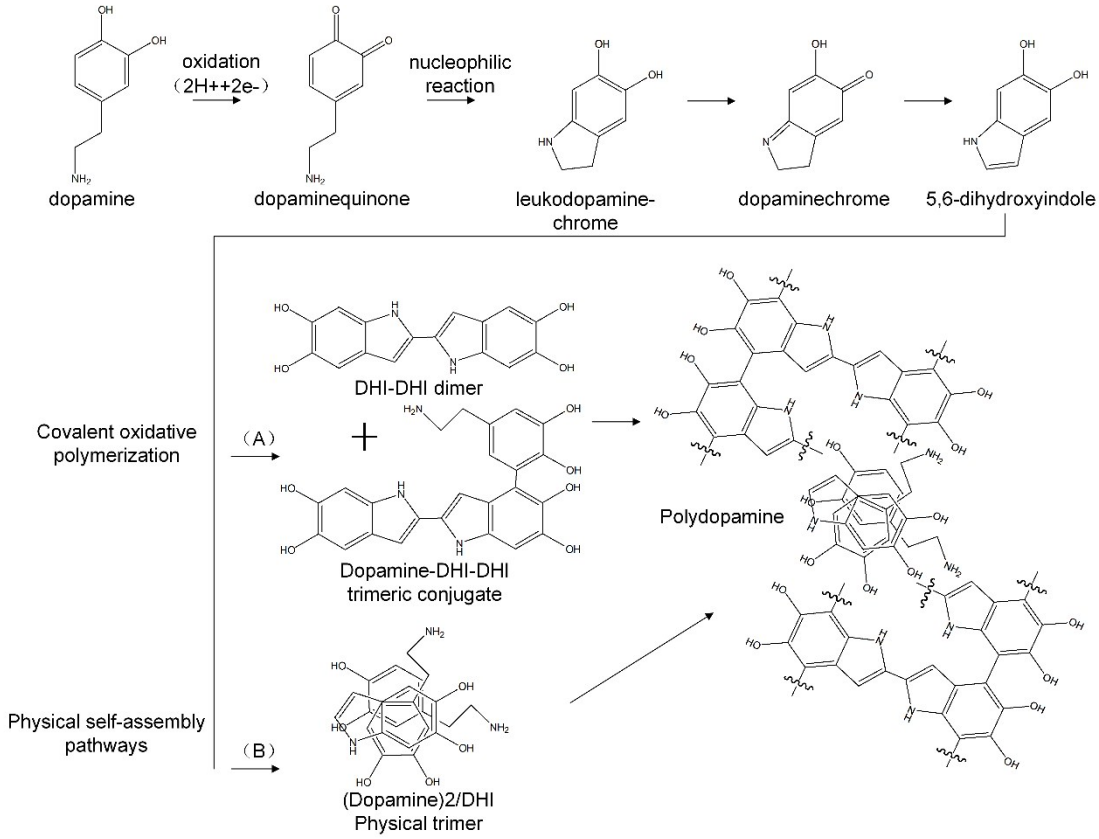

Fig. S5 A possible polymerization mechanism of polydopamine (PDA).

References

1 W. Zhang, F. K. Yang, Z. H. Pan, J. Zhang and B. X. Zhao, *Macromol. Rapid Comm.*, 2014, **35**, 350-354.

2 T. I. W. Schnoor, G. Smith, D. Eder, K. K. K. Koziol, G. T. Burstein, A. H. Windle and K. Schulte, *Carbon*, 2013, **60**, 229-235.