

Supporting Information

Soluble Polymer facilely in-situ self-grown on conducting substrates at room temperature towards electrochromic application

Xiongchao Shao^a, Yuhua Yang^a, Qidi Huang^a, Dacheng Dai^a, Haichang Fu^a, Guohua Gong^b, Cheng Zhang^a, Mi Ouyang^{*a}, Weijun Li^a, Yujie Dong^{*a}

^a College of Chemical Engineering, Zhejiang University of Technology, Hangzhou 310014, P. R. China.

^b Oriental Anasak Crop Technology Co. LTD, Longyou, 324400, P. R. China.

* Corresponding authors:

ouyang@zjut.edu.cn, Tel: +86-571-88320929 (Mi Ouyang)

dongyujie@zjut.edu.cn, Tel: +86-571-88320929 (Yujie Dong)

Compound (1)

Dibromoneopentyl glycol (40mmol, 10.47 g), 3,4-dimethoxythiophene (20 mmol, 2.88 g) and PTSA (0.6 g) as catalyst was added into a round bottom flask, then 50 mL toluene was injected as solvents. The mixture was heated to reflux and stirred continuously for 18 h in N₂ atmosphere. After cooling to room temperature, toluene was removed by rotatory evaporator, then the crude product was extracted with DCM, then the organic layer was washed with brine and dried with MgSO₄, and purified on a silica gel column (DCM : PE = 1 : 4 v : v as eluent) to obtain the product as an colorless oil. ¹H NMR (500 MHz, CDCl₃), δ 6.50 (s, 2H), 4.10 (s, 4H), 3.61 (s, 4H).

Compound (2)

5-hydroxym-phthalic acid (20 mmol, 3.64 g) and 2-ethylhexanol (60 mmol, 8.0 g) were added to a 100 mL two-mouth reaction flask, and 40 mL toluene was injected as solvents, then, 1.5 mL concentrated sulfuric acid as catalyst and a small amount of molecular sieve as absorbent agent was slowly added under stirring conditions. Cooling to room temperature after heated to reflux for 15 h, deionized water was added slowly, and the crude product was extracted with dichloromethane and saturated salt water for three times, then the extraction solution of the organic layer was dried with MgSO₄ and purified by chromatographic column (EA: PE = 1:15 v : v as eluent). The product was 7.10 colorless oil liquid, and the yield was 87.6%. ¹H NMR (500 MHz, CDCl₃), δ 8.22 (t, *J* = 1.4 Hz, 1H), 7.76 (d, *J* = 1.4 Hz, 2H), 6.65 (s, 1H), 4.26 (m, 5.7 Hz, 4 h), 1.71 (m, 6.0 Hz, 2 h), 1.50 1.27 (m, 16 h), 0.97 0.86 (m, 12 h).

Compound (M1)

Compound (1) 1.71 g (5mmol) and an appropriate amount of potassium iodide KI, potassium carbonate 4.5 g (25mmol), were added to the reaction flask. Then 6.09 g (15 mmol) of compound (2) was added to the reaction system, and the reaction was carried out overnight at 140 °C with DMF as the solvent under N₂ atmosphere. The crude product was extracted with dichloromethane and saturated salt water for three times, and then the organic layer was dried with MgSO₄ and purified by chromatographic column (EA: PE = 1:15 v : v as eluent) to obtain 4.46 oil product. The yield was 90%. ¹H NMR (500 MHz, CDCl₃), delta 8.26 (t, *J* = 1.3 Hz, 2 h), 7.75 (d, *J* = 1.4 Hz, 4 h), 6.51 (s, 2 h), 4.37 (m, 4 h), 4.24 (m, 4 h), 4.15 (d, 8 h), 1.74 1.71 (m, 4 h), 1.47 1.27 (m, 32 h), 0.94 0.90 (d, *J* = 9.7, 4.2 Hz, 24 h).

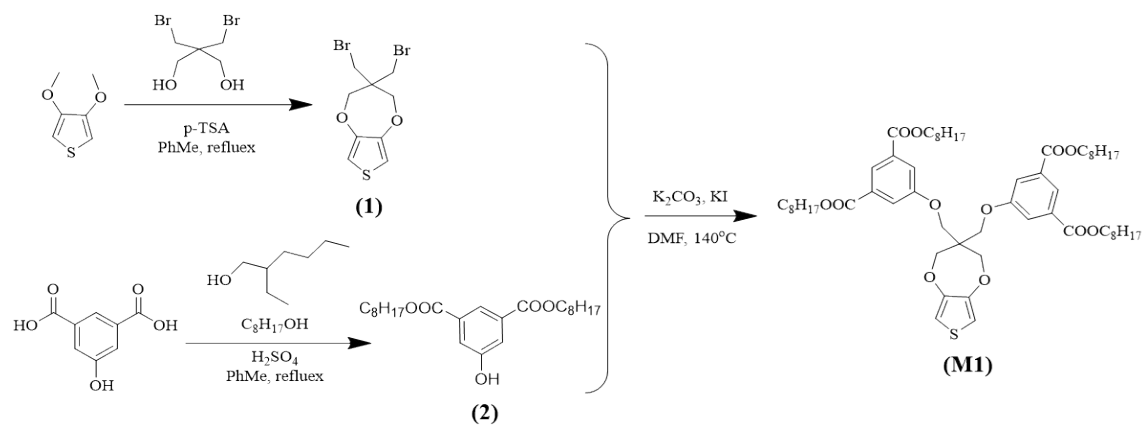


Figure S1. Synthesis methods.

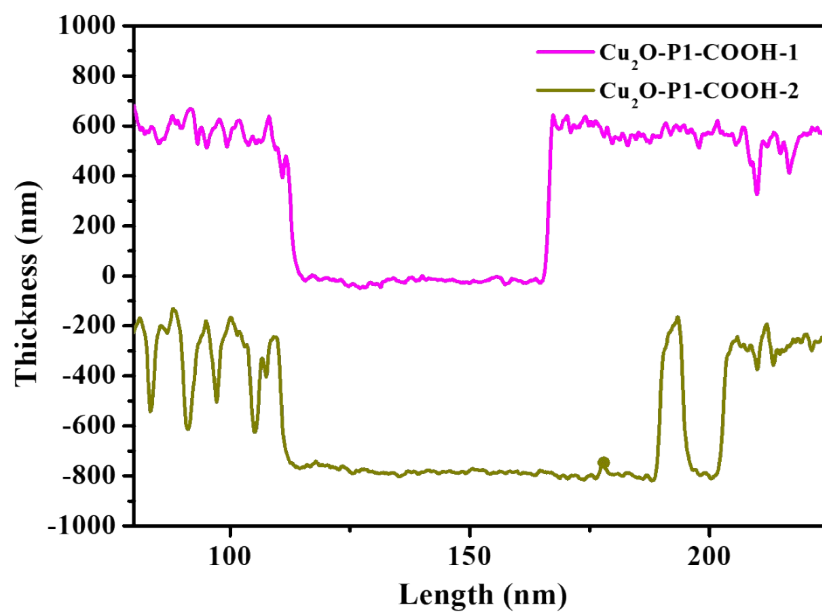


Figure S2. Thickness of two different films prepared by self-growth film.

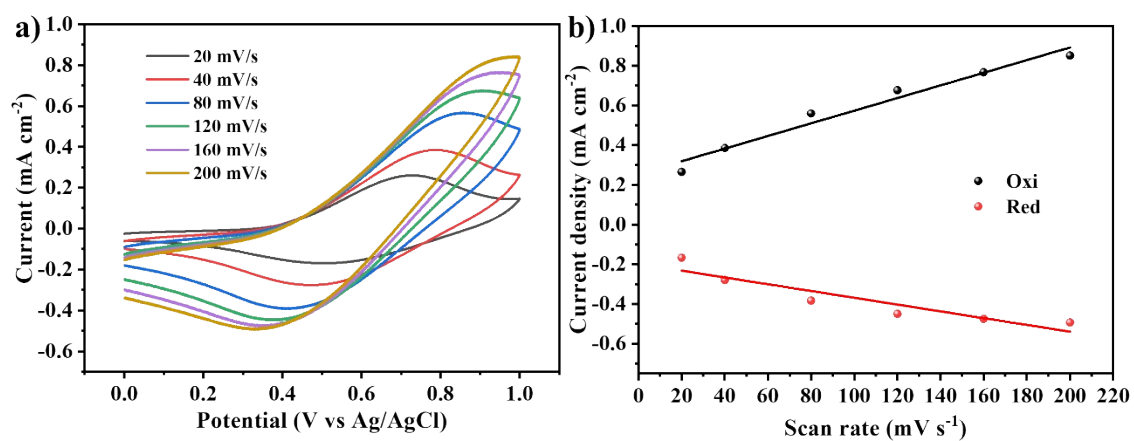


Figure S3. a) CV curves of Cu₂O-P1-COOH at different scanning rates from 20 to 200 mV/s.
 b) Scanning rate dependences of the anodic and cathodic peak currents.