Supporting information

Conjugated Polyelectrolyte with the Backbone Integrated by Benzene and Fluorene for Mimicking Neural Synapses and Associative Learning

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Experimental section

General

All organic solvents were redistilled under dry nitrogen. All the operations were performed under purified argon. All chemicals were purchased from Aldrich and used without further purification. Ultraviolet/visible (UV/Vis) absorption spectra were measured on a Shimadzu UV-2540 spectrophotometer. A HORIBA JOBIN YVON Fluoromax-4 spectrofluorometer was used to record the steady-state fluorescence spectra. All samples for the fluorescence measurement were dissolved in dry solvent, filtered, transferred to a long quartz cell, and then capped and bubbled with dry nitrogen for 15 min. Fourier transform infrared (FTIR) spectra were recorded by Spectrum 100 spectrophotometer (Perkin Elmer, Inc., USA). ^{1}H-nuclear magnetic resonance spectra were recorded on a Bruker 400 spectrometer in deuterated solution with a tetramethylsilane (TMS) as a reference for the chemical shifts. X-ray photoelectron spectroscopy (XPS) measurements were carried out on an ESCALAB 250Xi (Thermo Fisher) with Al Kα radiation as X-ray source for radiation. The number-average (M_n) and weight-

average (M_w) molecular weights of the polymers were determined with a Waters 2690 gel permeation chromatography (GPC) using a polystyrene standards eluting with THF. Thermogravimetric analysis (TGA) curve was recorded by TGA-Q500 thermogravimetric analyzer and tested in nitrogen atmosphere at a heating rate of 20℃/min. Atomic force microscopy (AFM) and kelvin probe force microscopy (KPFM) measurements were performed using Bruker Dimension Icon. The surface topography was obtained by tapping mode, and the surface potential was measured by Nap mode. A piezoresponse force microscopy (PFM) mode is used to apply voltage to the film. Cyclic voltammetry (CV) was performed on a Chenhua 650D electrochemical analyzer in degased acetonitrile containing recrystallized tetra-n-butylammonium-hexafluorophosphate ($TBAPF_6$, 0.1 M) as supporting electrolyte at 298 K. A conventional three-electrode cell was used with a platinum disk working electrode (surface area of 0.3 mm^2) and a platinum wire as the counter electrode. The Pt working electrode was routinely polished with alumina suspension and rinsed with acetone before use. The measured potentials were recorded with respect to the Ag/AgCl (0.01M) reference electrode. All electrochemical measurements were carried out in nitrogen.

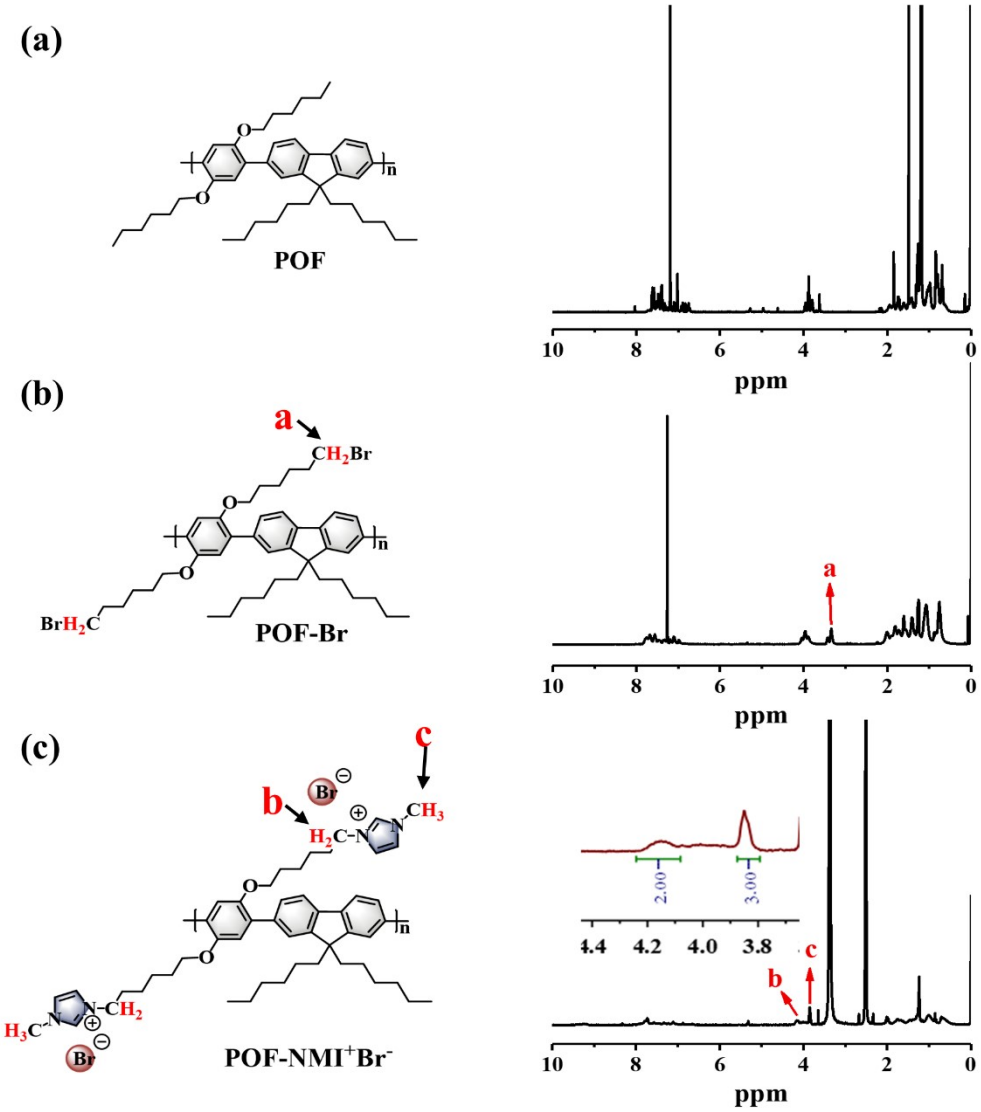

Figure S1. ^{1}H-NMR spectra of the as-synthesized materials in (a,b) $CDCl_3$ and (c) DMSO-d_6.

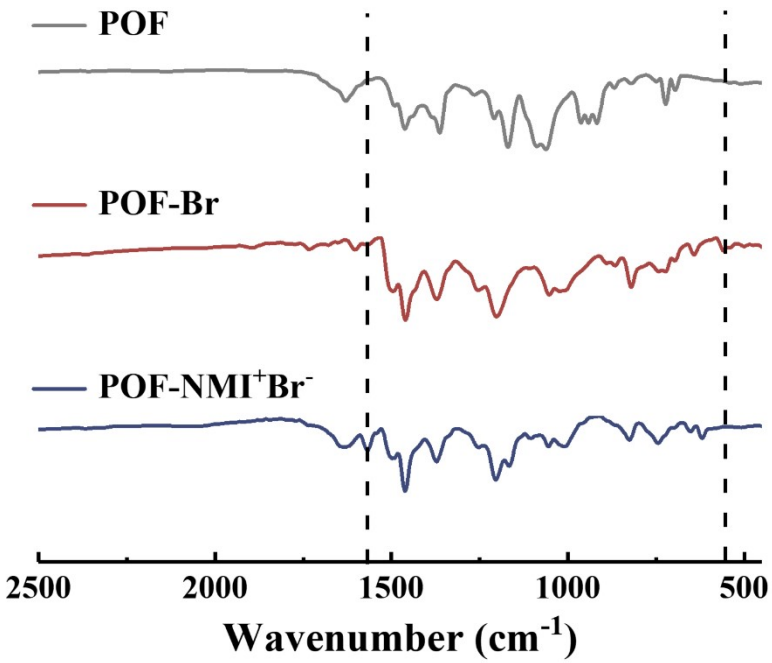

Figure S2. FTIR spectra of the materials dispersed in KBr pellets.

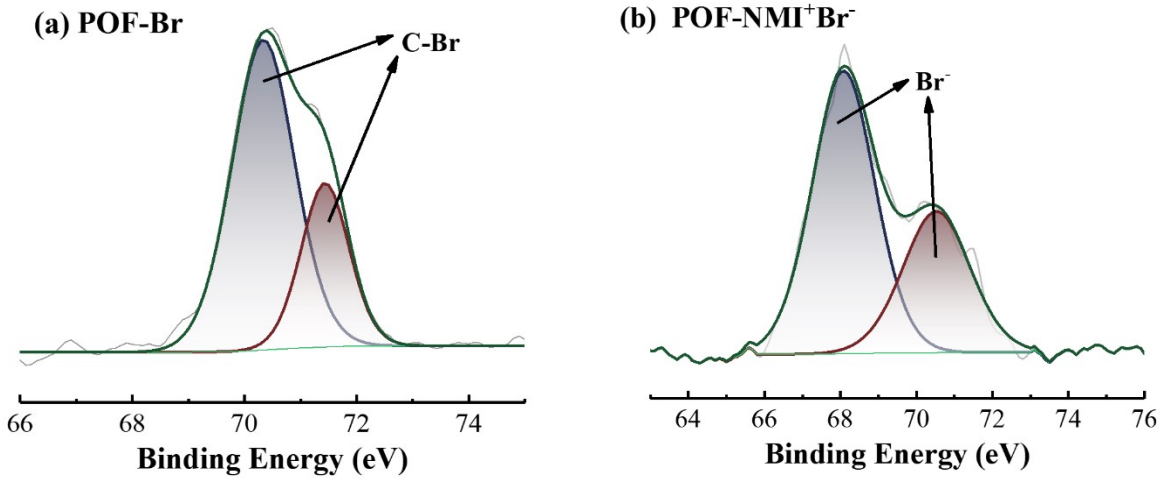

Figure S3 Br3d core-level XPS spectra of (a) POF-Br and (b)POF-NMI^{+}Br^{-}

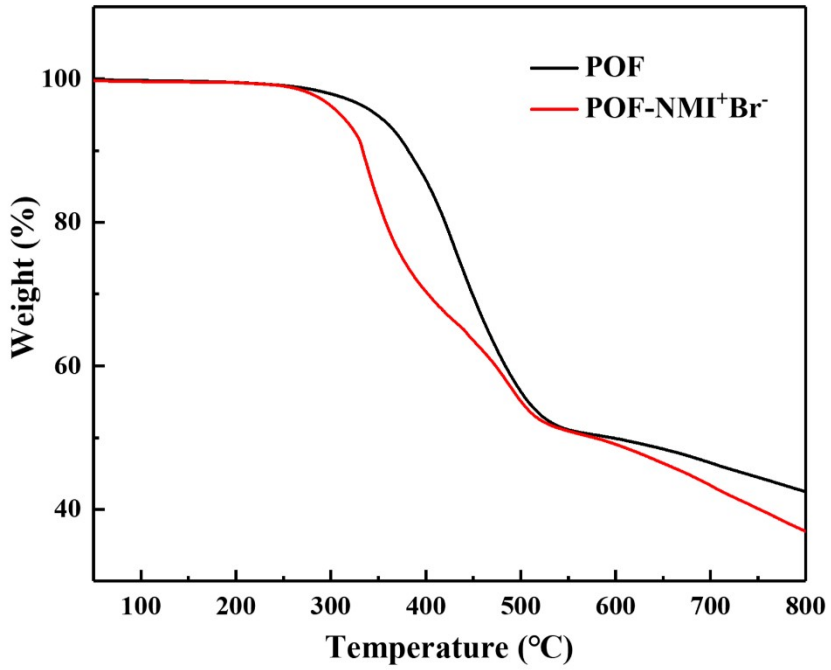

Figure S4. TGA curves of the samples in flowing (100 mL min^{-1}) N_2.

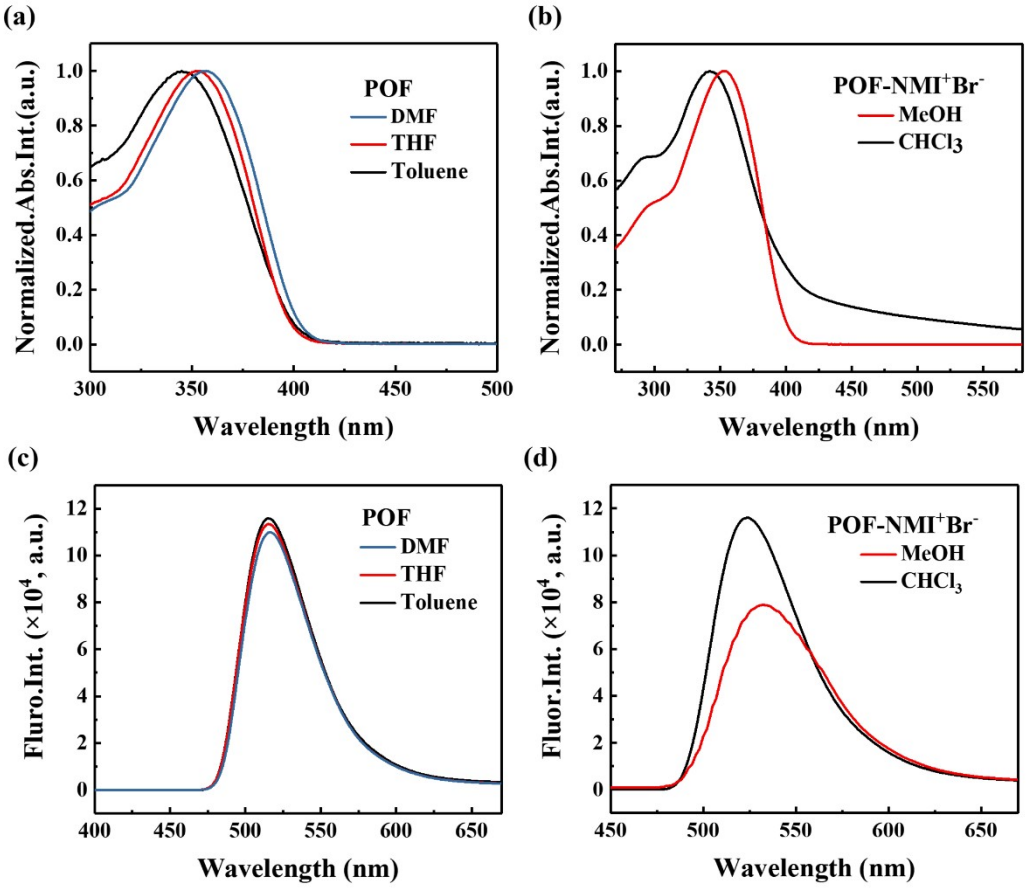

Figure S5. (a,b) UV/Vis absorption and (c,d) photoluminescence ($\lambda_{ex.}$=342 nm) spectra of the materials in different organic solvents.

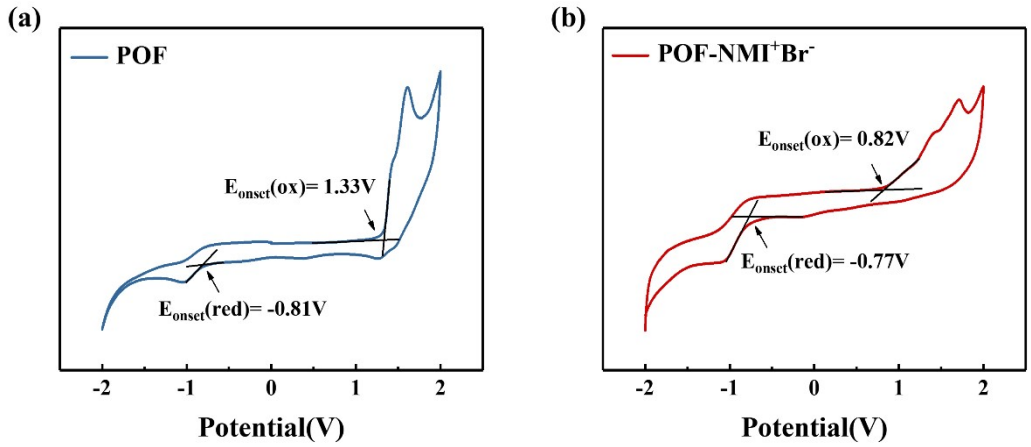

Figure S6. Cyclic voltammograms for the sample films coated on Pt at ambient temperature. Scan rate: 100 mV/s. Reference electrode: Ag/AgCl. Electrolyte: $TBAPF_6$ (0.1M) in deaerated acetonitrile.

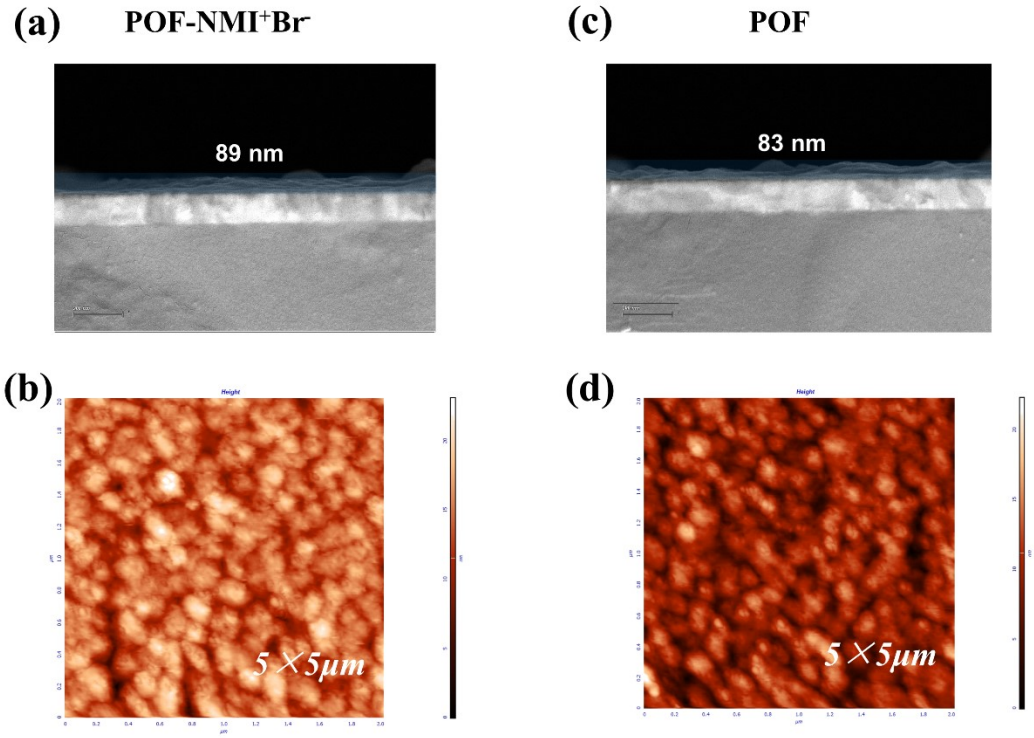

Figure S7. (a,c) The cross-section SEM images (marked in blue) and (b,d) the AFM images of (a,b) the POF-NMI$^+$Br$^-$ film and (c,d) the POF $^-$film.