Supplementary Information for

Materials Interaction in Aggregation-Induced Emission (AIE)-Based Fluorescent Resin all Toward Smart Coatings

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S1 Experimental

S1.0 Materials

Bisphenol A and Epichlorohydrin and Diethylenetriamine were purchased from Aladdin Reagents (Shanghai) Co. Ltd (≥99%). TPE-2CH$_2$Br was synthesized and characterized according to our previous work (see Reference 28). NaOH and Triethylamine were purchased from Shanghai Sinopharm Group Chemical Reagent Co., Ltd(≥99%). Ammonia was provided by Nantong Sanjiang Chemical Co. Ltd. Xylene, Anhydrous ethanol and Ethylene glycol monobutyl ether were bought from Changzhou Xuhong Chemical Co. Ltd. THF were obtained from Chinasun Specialty Products Co. Ltd (≥99.0%). Deionized water were specially prepared in our Laboratory.

S1.1 Synthesis of fluorescent resin

TPE-2CH$_2$Br was dissolved in 5ml THF, and bisphenol A was dissolved in ethanol and ethylene glycol monobutyl ether mixed solvent, they were added to a 250ml two-necked round bottom flask after evenly stirred. The reaction was performed under NaOH catalysis at 80℃ for 6 hrs, then the reaction temperature was decreased to 65°C, and epichlorohydrin was added. After that, the remaining NaOH solution was continuously added dropwise for 20 mins. A pale yellow transparent solution can be obtained after 4 hrs of incubation, the other reaction conditions were maintained during this period. The solution was placed on a rotary evaporator in order to remove the supernatant and continue to wash the product with deionized water to remove the excess sodium hydroxide and sodium chloride solution until the pH of the solution is neutral. The mixed solvent was add again to obtain a re-transparency solution, and the solvent was removed and dried in a vacuum oven at low temperature to get a pale yellow transparent solid eventually (a strong yellow-green fluorescence under a 365nm UV lamp can be seen).

S1.2 Sample preparation

1. Fluorescent epoxy resin and curing agent (diethylenetriamine, polyamide 650) were mixed in solvent butyl acetate. The mixed solution was coated on the quartz plate and tinplate plate, and was dried to obtain a fluorescent coating. The fluorescent coatings for other tests were also prepared according to the same procedure.

2. The fluorescent resin and inorganic powder (talc, mica powder) were mixed at a certain mass ratio, ultrasonic dispersed at room temperature for 10 mins to obtain a mixed hybrid solution and then add the diethylene triamine as curing agent. The mixed solution was coated on a quartz plate and dried to obtain a hybrid coating.

S2 Characterization

^{1}H NMR spectra were measured on Bruker ARX 400 NMR spectrometers using $CDCl_3$ as the deuterated solvent and tetramethylsilane (TMS; $\delta=0$ ppm) as the internal standard. FTIR spectra were recorded on a Perkin-Elmer 16 PC FTIR spectrophotometer. Images of scanning electron microscopy (SEM) were taken on a JSM-6700F electron microscope. Thermogravimetric analysis (TGA) measurements were carried out under nitrogen or in air on a Perkin-Elmer TGA 7 analyzer at a heating rate of 10 C min^{-1}. Relative number (Mn) and weight-average (Mw) molecular weights and polydispersity indices (PDI or Mw/Mn) of the TPE-PDMS oligomers were estimated by a Waters Associates gel permeation chromatography (GPC) system equipped with RI and UV detectors. THF was used as eluent at a flow rate of 1.0mL min^{-1}. X-ray diffraction (XRD) measurements were performed using an XRD diffraction (D-MAX 2200 VPC) equipped with Ni-filtered Cu/Ka radiation, having a wavelength of 0.154nm. UV-vis absorption and light transmission spectra were measured on a Milton Roy Spectronic 3000 array spectrophotometer. Photoluminescence (PL) spectra were recorded on a Perkin Elmer LS 55 spectrofluoromerter. Fluorescence microscopy images(CFM) were recorded on a confocal laser scanning microscope(Leica, TCS SP8). EIS was conducted with an olartron 2350 electrochemical interface and a Solartron 1260 impedance/gain-phase analyzer.

Mechanical characterization

Coatings with a wet thickness of 100 μm were cast on stainless steel plates to test physical and mechanical performance. After doping with curing agent, the coatings were air-dried at room temperature (25 ℃) for 2 days. Mechanical parameters were measured by national standard methods of China, such as hardness, adhesion, impact strength and flexibility.
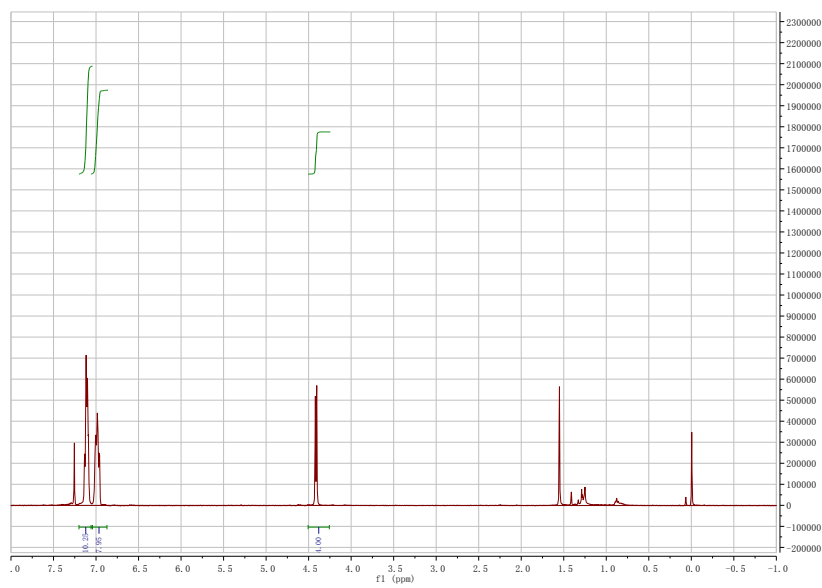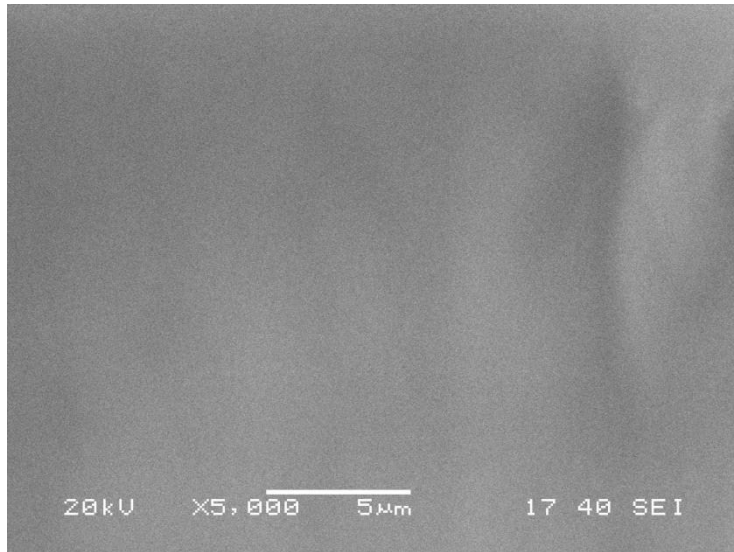
Fig. S1 ^{1}H NMR of TPE-2CH$_2$Br
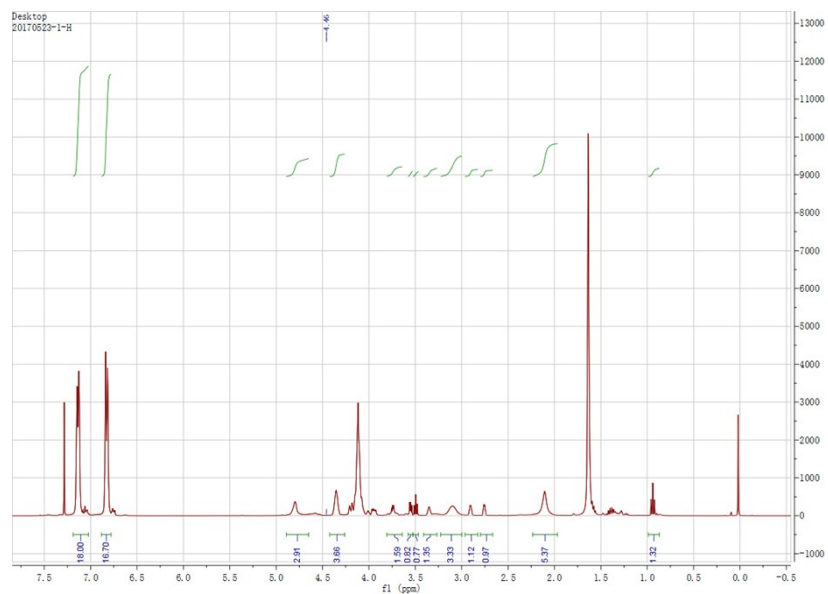
Fig. S2 ^{1}H NMR of TPE-EPOXY-3
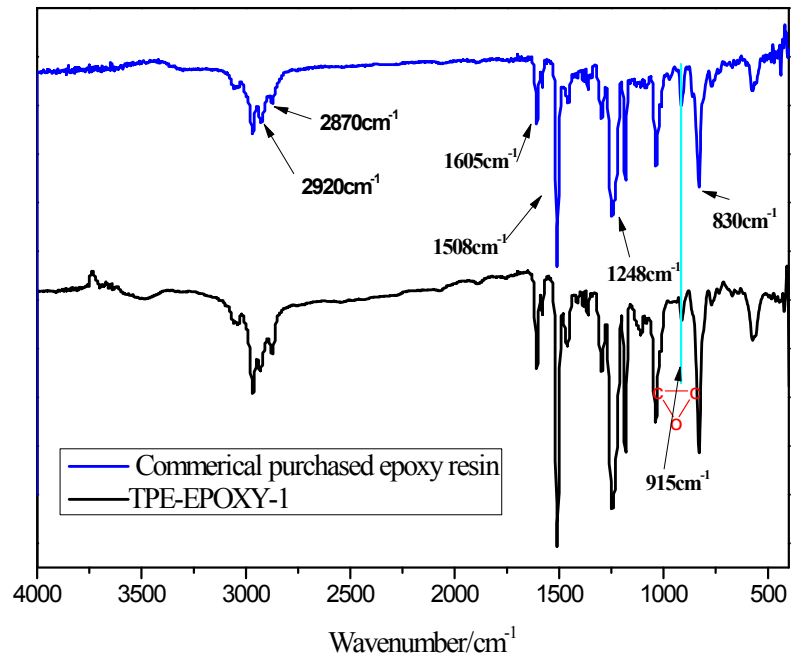
Fig. S3 FTIR curves of Synthetic fluorescent resin (TPE-EPOXY-1) and commercial purchased epoxy resin

Fig. S4 Surface topography of the cured fluorescent epoxy coating based on TPE–EPOXY-1 resin observed by SEM measurement

Fig. S5 Electrochemical impedance curve equivalent circuit diagram of fluorescent coating soaked in 3.5% NaCl solution; a) The first stage of corrosion; b) The second stage of corrosion; c) The third stage of corrosion
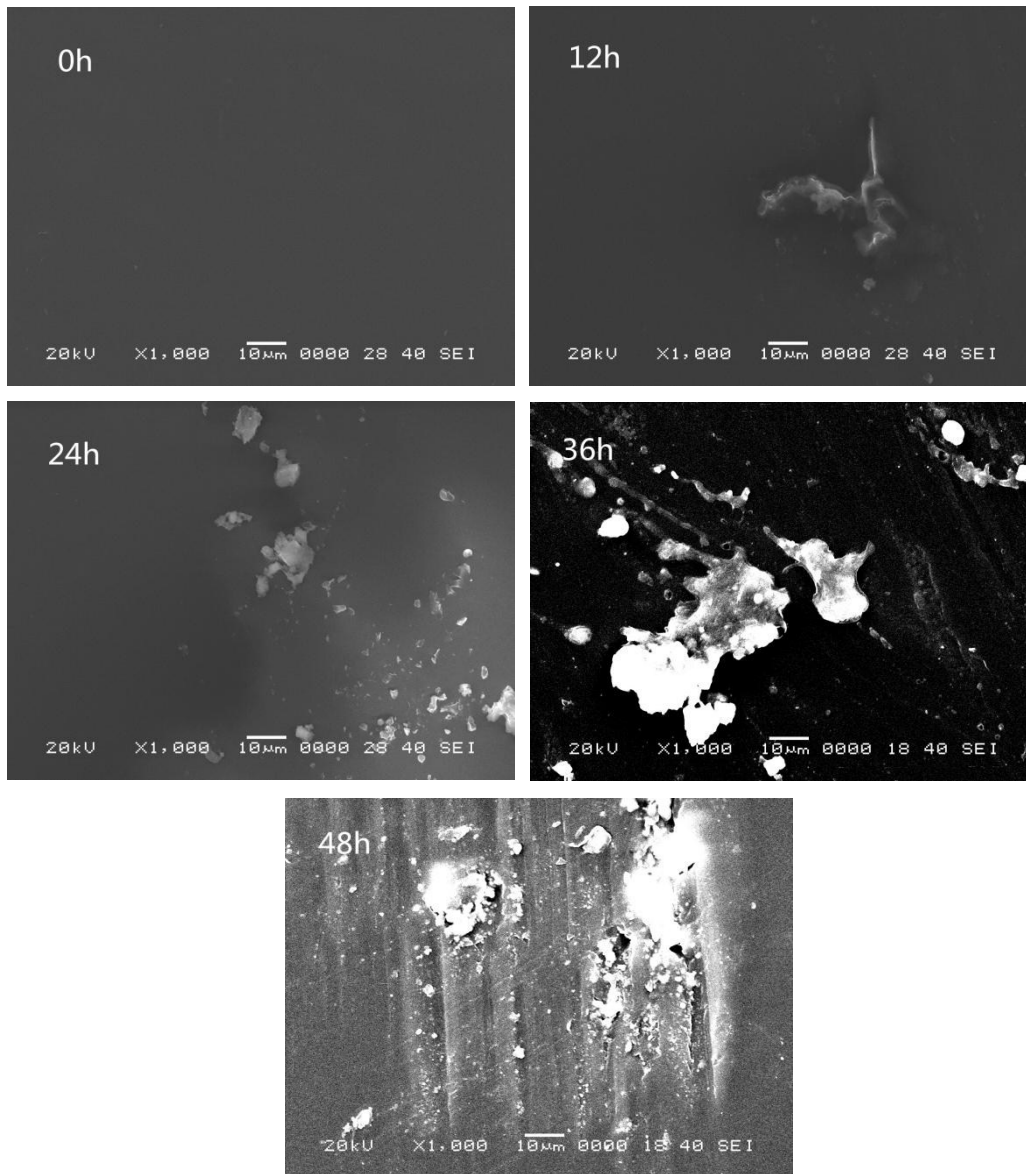
Fig.S6 SEM images of the fluorescent coating (TPE-EPOXY-1 cured by diethylenetriamine) in the corrosion process varied with soaking time

Table. S1 Molecular weight and fluorescent quantum yield (Φ_F) of fluorescent resins with different amount of TPE-2CH$_2$Br

Sample	Bisphenol A:TPE-2CH$_2$Br：Epichlorohydrin (mol)	M_n	M_w	P	Φ_F
TPE-EPOXY-1	1:0.01:1	970	1146	1.181261	5.7%
TPE-EPOXY-2	1:0.004:1	937	1101	1.175545	4.8%
TPE-EPOXY-3	1:0.002:1	936	1102	1.177175	4.1%
TPE-EPOXY-4	1:0.001:1	937	1102	1.177049	3.1%

Table. S2 Mechanical properties of fluorescent resins and commercial resins

Model	Pencil hardness	Impact strength (Kg cm)	Flexibility(mm)
Commodity resin	6H	≥30	≤5
Fluorescent resin	3H	≥50	≤1

Table. S3 AC impedance for coating during immersion in 3.5wt% NaCl solution

Immersion time(h)	Resistance value Rre(kΩ)
0	734.5
12	225.2
24	18.81
36	17.24
48	13.97