*Supporting information*

*of*

# Water-soluble Phosphorescent Conjugated Polymer Brush for Tumor-targeted Photodynamic Therapy

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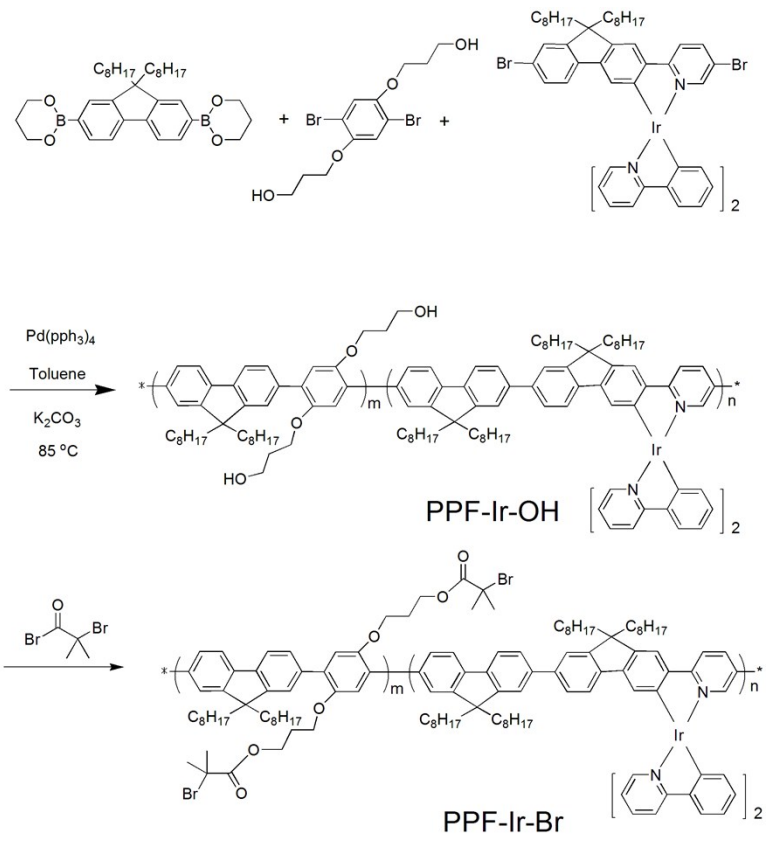


**Scheme S1** Synthesis of PPF-Ir-Br.

**Synthesis of macroinitiator precursor Poly[(9,9-Dioctylfluorene)-alt-(1,4-Bis((6-propanol)oxy)-benzene-co-$(ppy)_2Ir(FlPy)$)] (PPF-Ir-OH)**

2, 7-bis (4, 4, 5, 5-tetramethyl-1, 3, 2-dioxaborolan-2-yl)-9, 9-dioctylfluorene (0.64g, 1.0 mmol), 1, 4- Bis((6-propanol)oxy)-2, 5-dibromobenzene (0.31g, 0.8 mmol), $(ppy)_2Ir(BrFlPyBr)$ (0.23g, 0.2 mmol) and tetrabutyl ammonium bromide (10 mg) were dissolved in toluene (8 mL, degassed), to which a solution of $K_2CO_3$ (5.3 mL, 2 M) was added, together with $Pd(PPh_3)_4$ (0.057 g). The resulting mixture was sealed in a glass vial and stirred at 85°C and refluxed for 48h in an oil bath. The mixture passed through a column of neutral alumina using THF (100 mL) and dichloromethane (200 mL) as eluant to remove catalyst and then condense the mixture to about 10mL and precipitated in methanol (500 mL); the polymer was filtered and washed with methanol and acetone and

then dried under vacuum for 24 h to acquire the polymers P1 (Yield: 0.67 g, 60%). The sample was characterized by $^1$H NMR and GPC, The number-average molecular weight and polydispersity of P1 are 22 000 and 2.3.

**Synthesis of Macroinitiator PPF-Ir-Br**

In a 100 mL flask, P1 (0.5 g, 0.83 mmol) was dissolved in 50 mL THF and then put the flask to the ice water mixture. The reagent of triethylamine (1.16 mL, 6.6 mmol) and 2-bromo-2-methylpropionyl bromide (0.82 mL, 8.3 mmol) were dropped to the mixture in turn. After the addition was complete, the solution was stirred at room temperature for 12 h. The mixture was washed by water, extracted with dichloromethane three times and dried using anhydrous magnesium sulfate. Then condense the mixture to about 10 mL and precipitated in methanol (500 mL); the polymer was filtered and washed with methanol and then dried under vacuum for 24 h to acquire the polymers P2 (Yield: 0.47 g, 95 %). The sample was characterized by $^1$H NMR and GPC, The number-average molecular weight and polydispersity of P2 are 26 000 and 2.3.

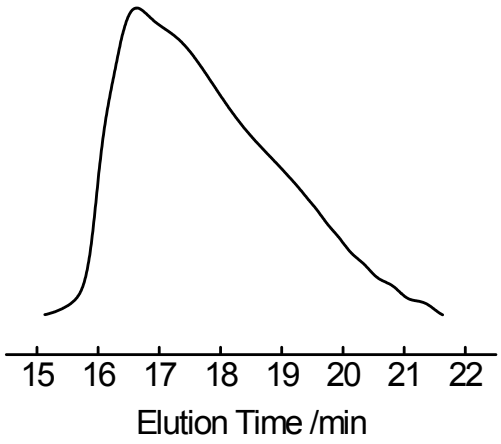


**Fig. S1** GPC trace of PPF-Ir-OH.

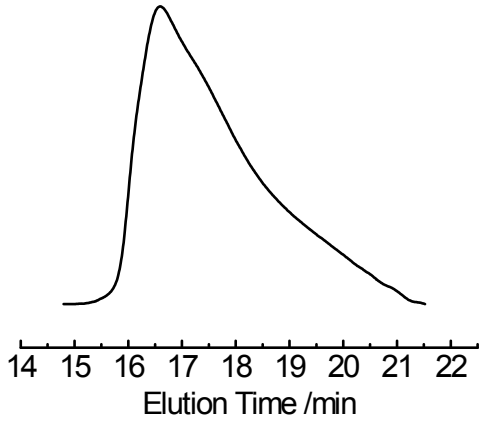


**Fig. S2** GPC trace of PPF-Ir-Br.

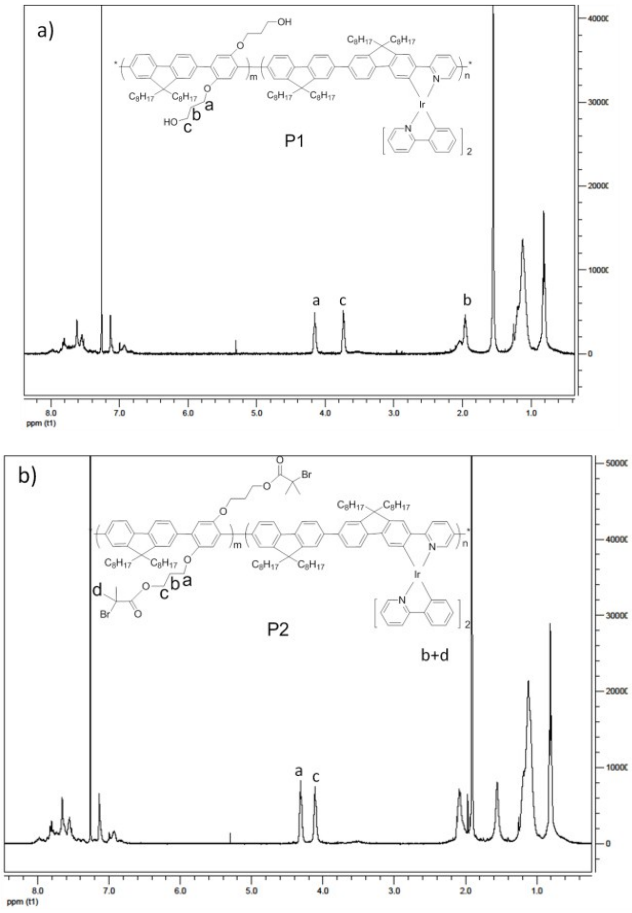


**Fig. S3** $^{1}$H NMR spectra of a) PPF-Ir-OH and b) PPF-Ir-Br in $CDCl_3$.

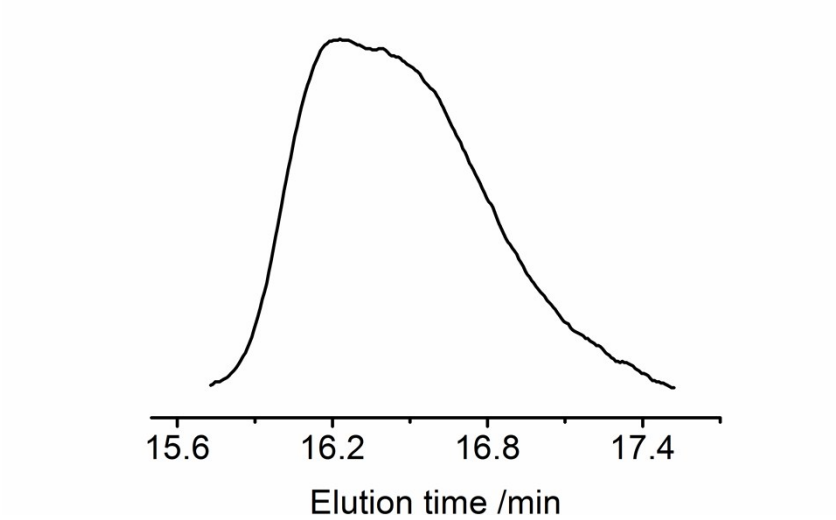


**Fig. S4** GPC trace of PPF-Ir-*g*-POEGMA.

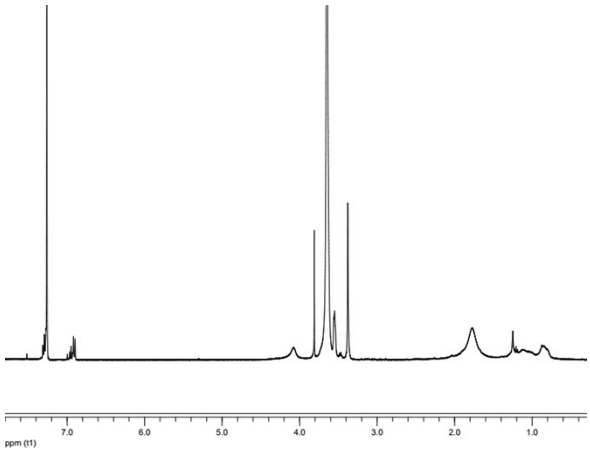


**Fig. S5** The $^{1}H$ NMR spectrum of PPF-Ir-*g*-POEGMA in $CDCl_3$.

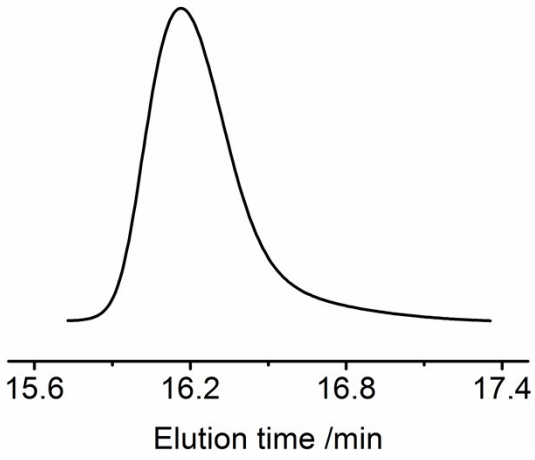


**Fig. S6** GPC of PPF-Ir-*g*-(POEGMA-*b*-PGMA).

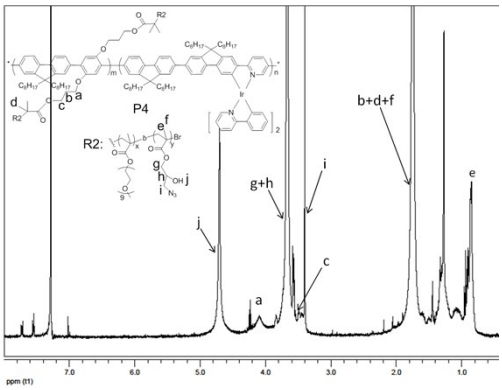


**Fig. S7** $^{1}$H NMR spectrum of PPF-Ir-*g*-(POEGMA-*b*-PGMA-$N_3$) in $CDCl_3$.

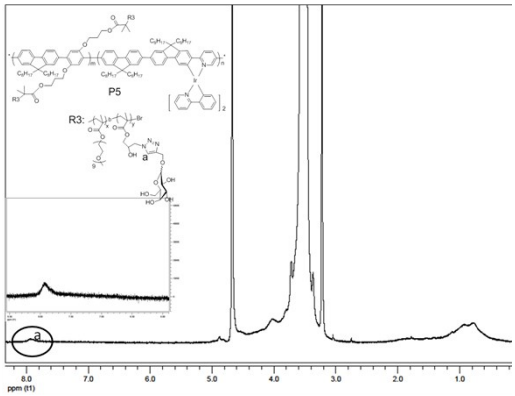


**Fig. S8** $^{1}$H NMR spectrum of PPF-Ir-*g*-(POEGMA-*b*-PGal) in $D_2O$.

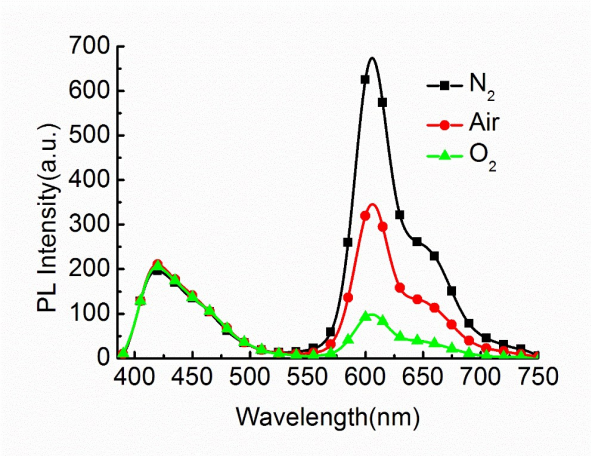


**Fig. S9** PL spectra of PPF-Ir-*g*-(POEGMA-*b*-PGal) aqueous solution under $N_2$, air, and $O_2$.

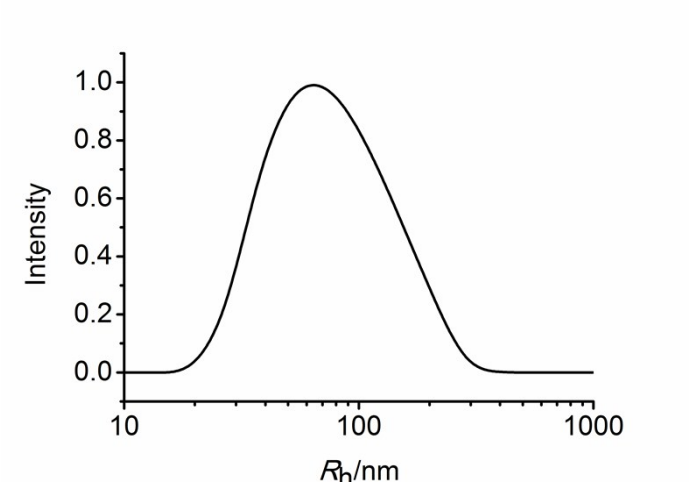


**Fig. S10** $R_h$ distribution of PPF-Ir-*g*-POEGMA in aqueous solution.

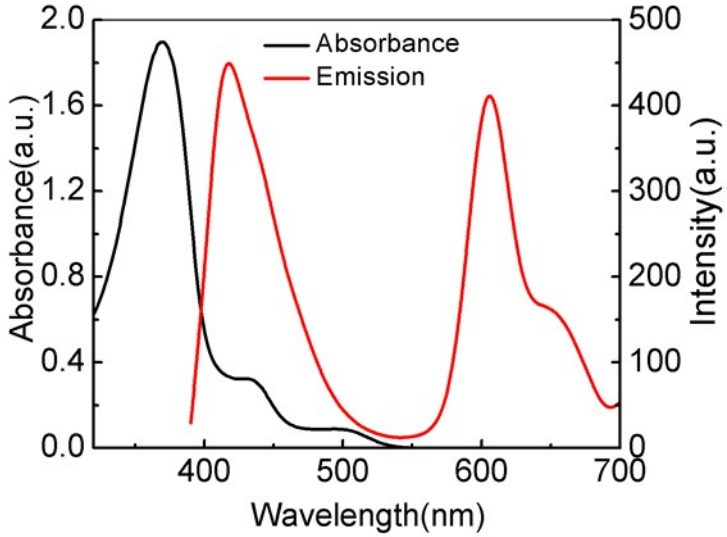


**Fig. S11** UV-vis-absorbance and fluorescent spectra of PPF-Ir-*g*-POEGMA in aqueous solution (1.0 mg/mL).

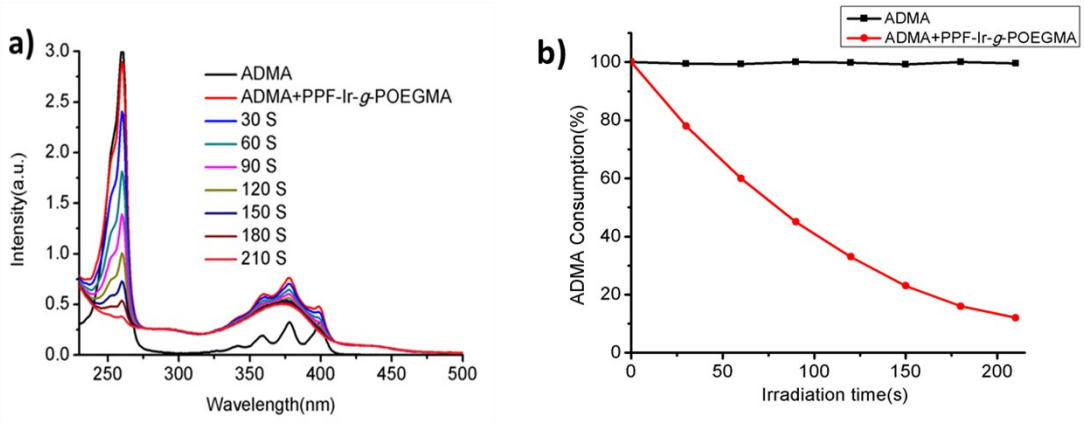


**Fig. S12** (a) Absorption spectra of ADMA (10 μg/mL) with PPF-Ir-*g*-POEGMA (0.1 mg/mL) in water under white light irradiation with power density 300 mW/cm$^2$ for different times (0-210 s). (b) Absorbance of ADMA at 259 nm as function of irradiation time under different irradiation intensity.