Supporting information

A Highly Effective *in Vivo* Photothermal Nanoplatform with Dual Image-Guided Therapy of Cancer Based on the Charge Reversal Complex of Dye and Iron Oxide

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Synthesis of the IR806-IONPS

The cyanine dye, IR-780, was selected as the starting material for the preparation of functionalized IONPs. Briefly, IR-780 (250 mg, 0.375 mmol) and 4-mercaptobenzoic acid (115.5 mg, 0.75 mmol) were dried in vacuum for 30 min. Anhydrous DMF (10 mL) was added, and the mixture was stirred at room temperature and overnight under an argon atmosphere. The crude product obtained after DMF was evaporated under reduced pressure and re-dissolved in DCM (5 mL). The solution was then filtered by PTFE filter and precipitated with large amount of diethyl ether. The golden product was thus obtained (250 mg, yield: 85%.)

The surface modification of IONPs with IR806 was done through a ligand-exchange reaction. In a typical process, 25 mg IONPs was mixed with 2.5 mg of IR806 dissolved in 10 mL chloroform solution and stirred for 48 h at room temperature. After reaction, the IR806 coated IONPs were obtained by centrifugation at 16000r/min and washed with ethanol several times and dried for further use.

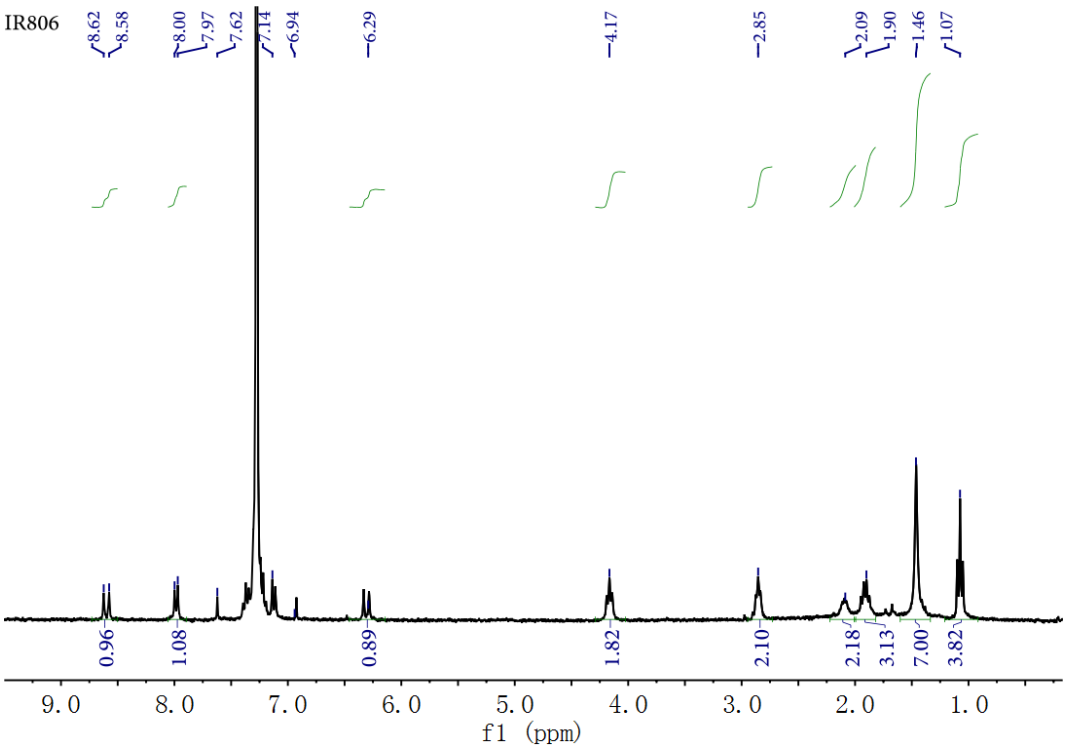

Fig. S1. ^{1}H NMR spectrum of IR-806 in $CDCl_3$.

The synthesis of IR 806 and its functionalized IONPs were confirmed by ^{1}H NMR, FT-IR and absorption spectra. The corresponding peaks attributed to IR 806 were observed from 1.0 to 8.6 ppm in Fig. S1. Additionally, the formation of IR806 was further confirmed by UV–Vis (Fig. 4a), in which a characteristic absorption peak around 806 nm was observed. IR806-coated IONPs was confirmed by FT-IR in Fig. S2.

^{1}H NMR (CDCl3): δ 8.62 (d, J = 14.1, 2H), 7.97 (d, J = 8.4, 2H), 7.33 (t, J = 7.7, 2H), 7.25 (t, J = 7.6, 4H), 7.17 (t, J = 7.4, 2H), 6.94 (d, J = 8.0, 2H), 6.29 (d, J = 14.1, 2H), 4.17 (t, J = 7.2, 4H), 2.85 (t, J = 5.8, 4H), 2.09 (s, 2H), 1.90 (d, J = 14.6, 7.3, 4H), 1.46 (s, 12H), 1.07 (t, J = 7.4, 6H).

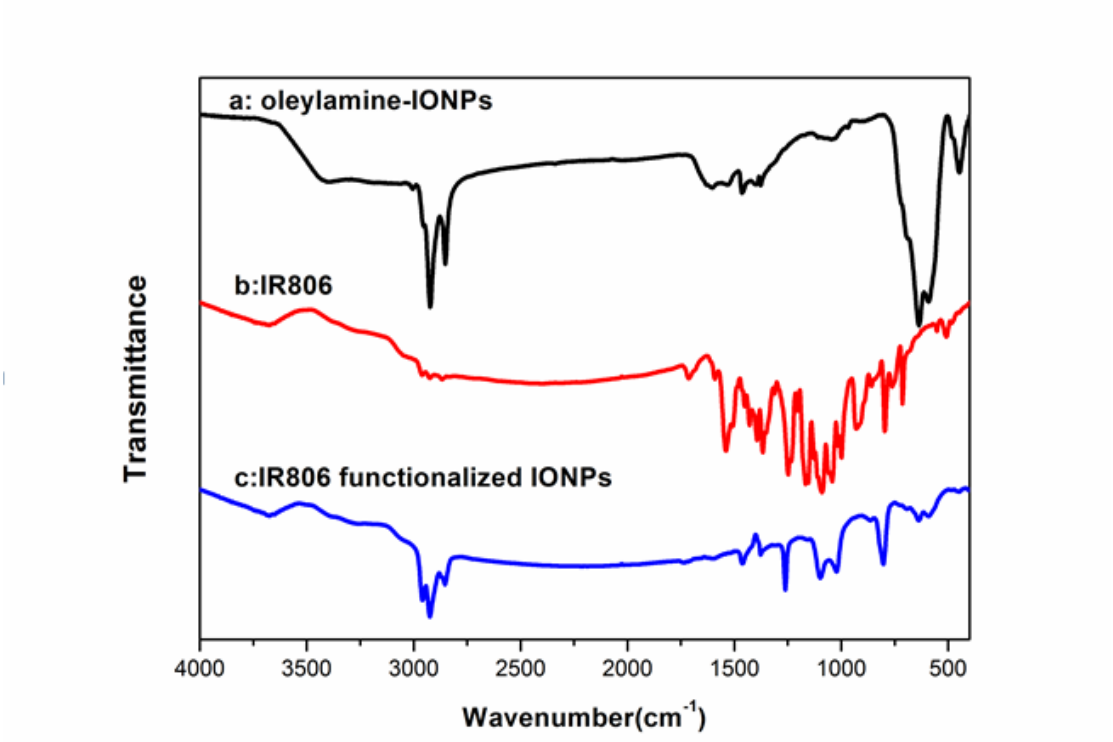

Fig. S2 FT-IR spectra of (a) oleylamine-coated IONPs (black line), (b) IR806 (red line), and (c) IR806-coated IONPs (blue line). Compared with the FT-IR spectra of the oleylamine-IONPs and IR806 dye, it can be found that the changes of the carbonyl region (υ = 1650-1750 cm^{-1}), which indicating the bond formation between the IR-806 carboxylic acid group and the IONPs core.

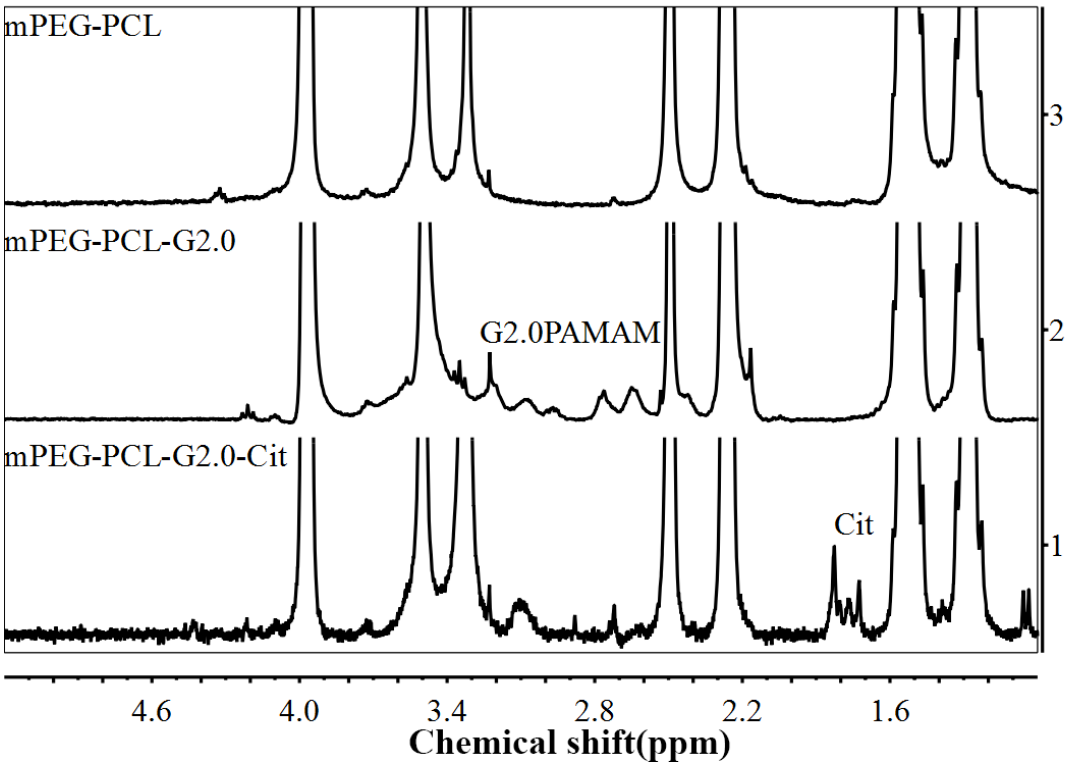

Fig. S3 ^{1}H NMR spectra of block polymer. (a) mPEG-PCL (b) mPEG-PCL-G2.0 PAMAM and (c) mPEG-PCL-G3.0-Cit

Typical signals of mPEG, PCL remain and in the meantime new signals appear. The signals at 1.28, 1.52, 2.6, and 3.97 ppm represent methylene protons of $–(CH_2)_3–$, $–OCCH_2–$, and $–CH_2OOC–$ in the PCL blocks, along with PEG block protons at 3.51 ppm. The new peaks at 2.5-2.8 ppm are assigned to the methane protons of $–CH_2NH–$, which belong to G2.0 dendrimer (Fig. S3b). The methyl protons of Cit appears at 1.76 ppm in Fig. S3c, confirming the successful preparation of the functional mPEG-PCL-G2.0-Cit polymer.

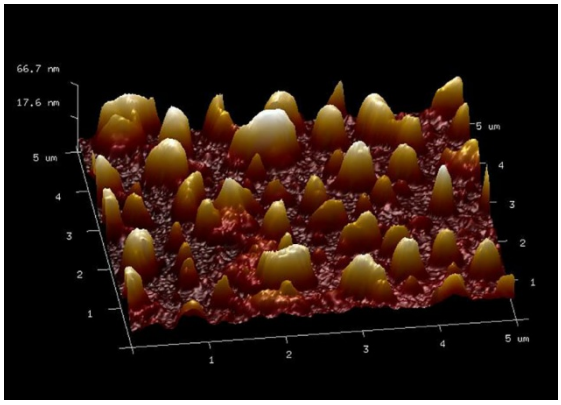

Fig. S4 AFM imaging of the smart hybrid micelles.

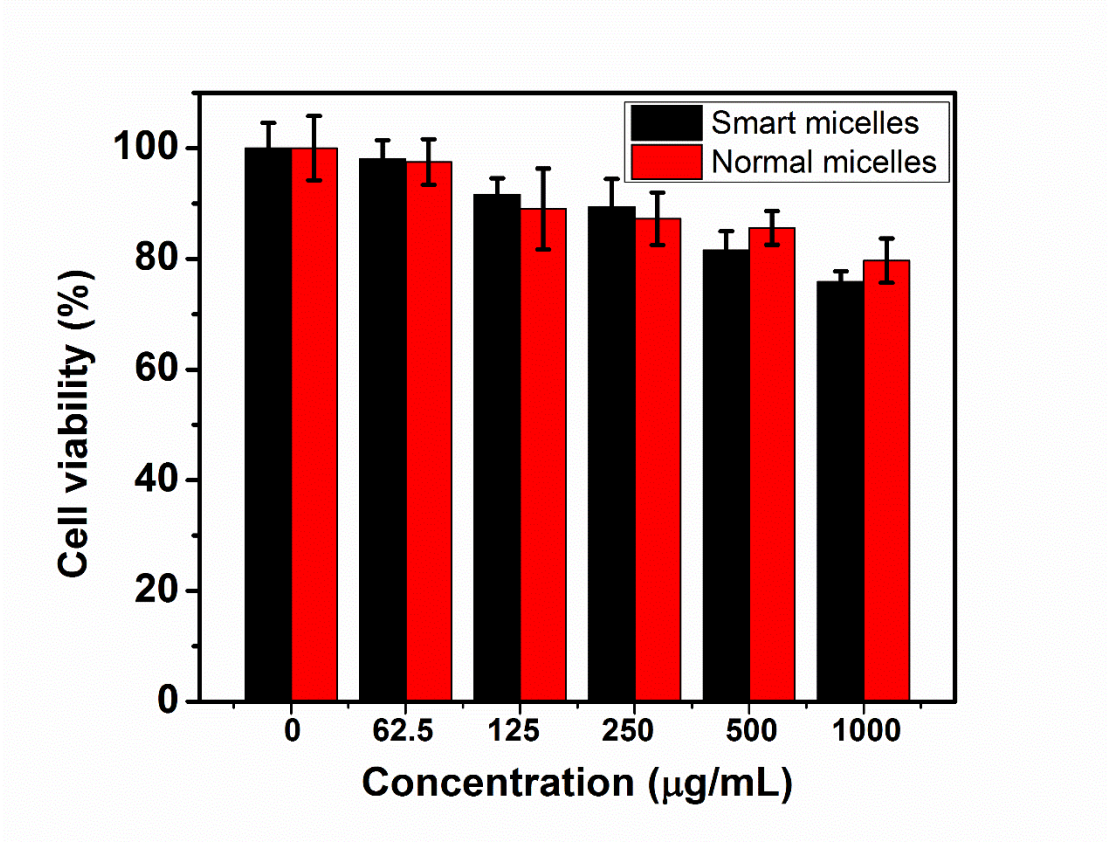

Fig. S5 (a) In vitro cell viability of BV2 cells incubated for 24h with different concentrations of smart hybrid micelles. Cell viability assays were carried out using MTT method. The error bars represent the standard deviations.

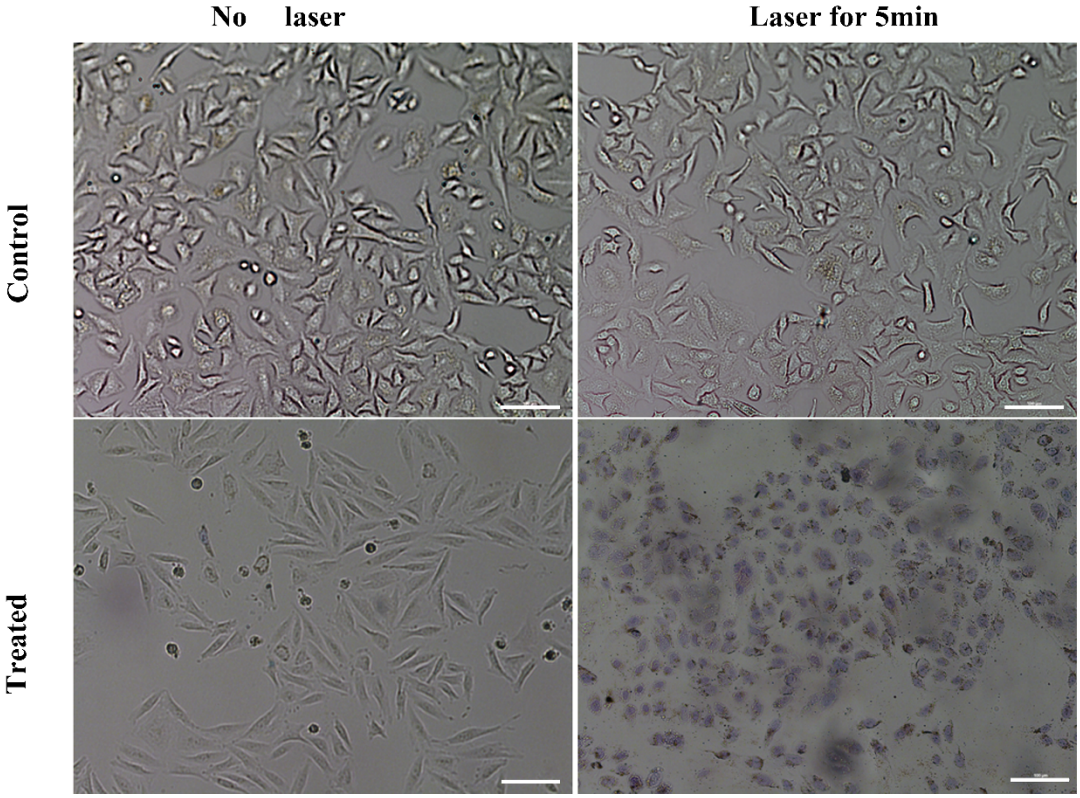

Fig S6 Trypan blue-stained images of A549 cells after PTT 5min. Viable cells will not be stained with trypan blue but dead cells could be stained. The scale bar is 100 μm.

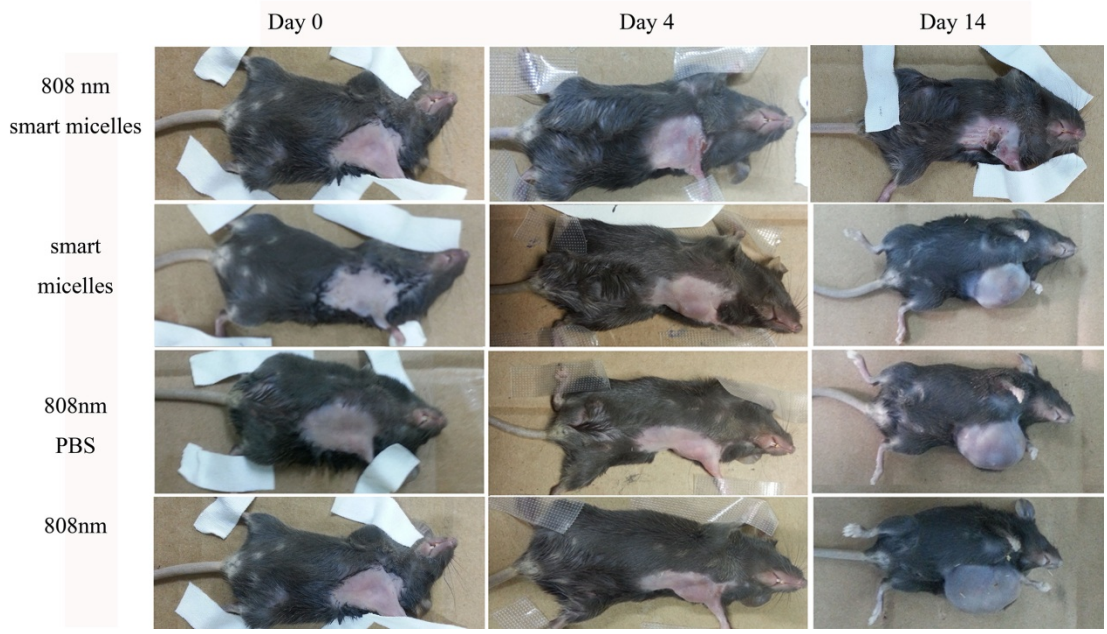

Fig. S7 Representative images of mice bearing LLC tumors after treatments. After 24 h tail vein injected, the mice were irradiated by 808 nm light with the power density of 0.25 W/cm^2.