Supplementary Information

Multifunctional α-Fe_2O_3@PEDOT Core-Shell Nanoplatform for Gene and Photothermal Combination Anticancer Therapy

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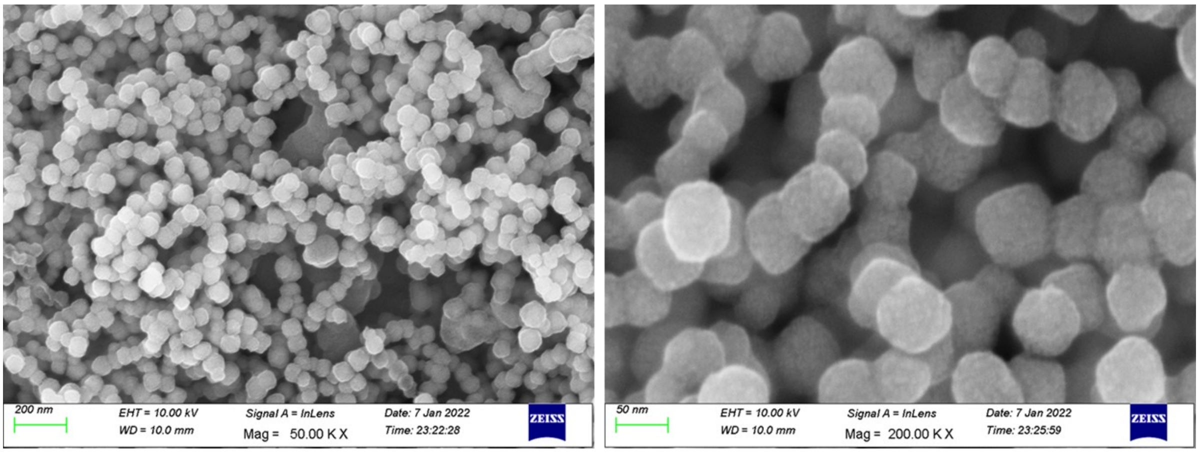


Fig. S1. SEM images of α-Fe_2O_3@PEDOT core-shell NPs.

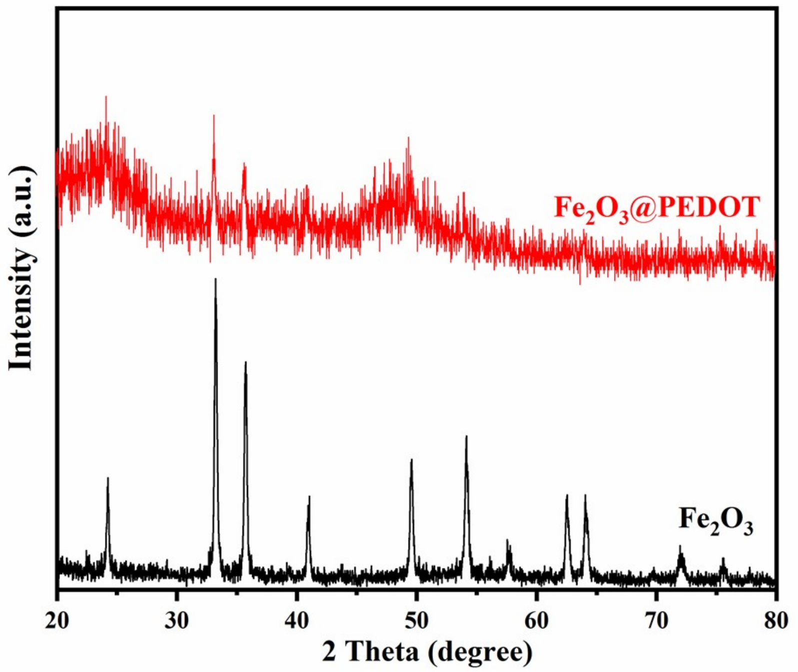
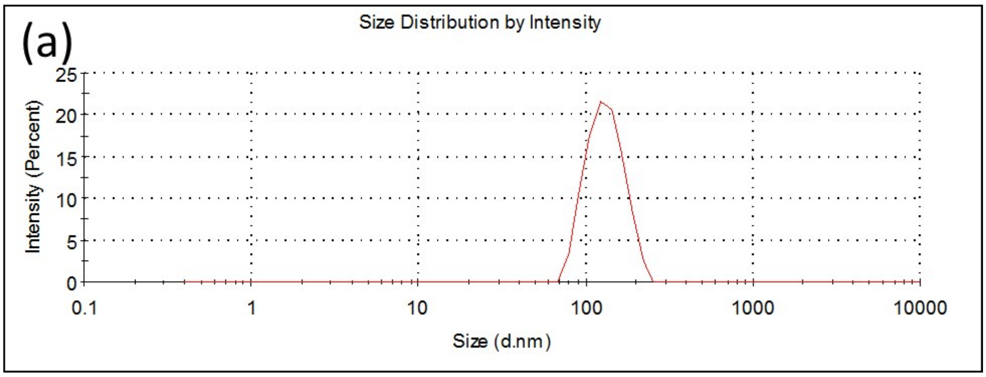


Fig. S2. X-ray diffraction (XRD) patterns of α-Fe_2O_3 NPs and α-Fe_2O_3@PEDOT core-shell NPs.



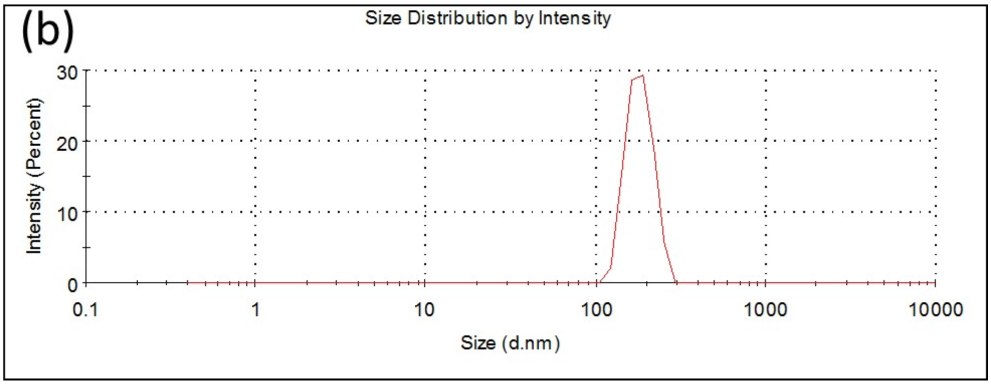


Fig. S3. Particles size distribution of (a) α-Fe_2O_3 nanocrystals, (b) α-Fe_2O_3@PEDOT core-shell NPs measured by dynamic laser scattering.

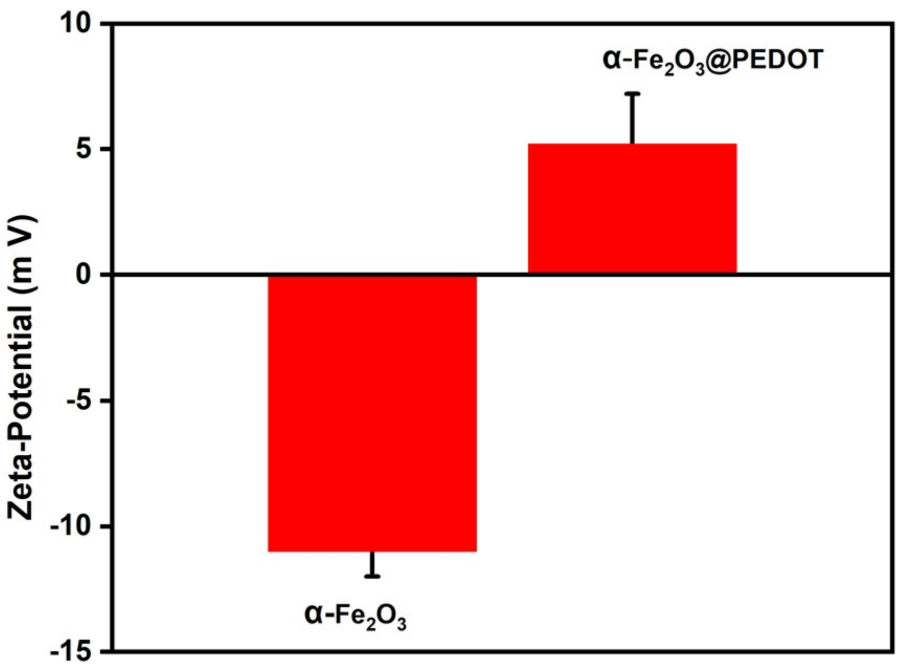


Fig. S4. Zeta potential of α-Fe_2O_3 NPs and Fe_2O_3@PEDOT core-shell NPs.

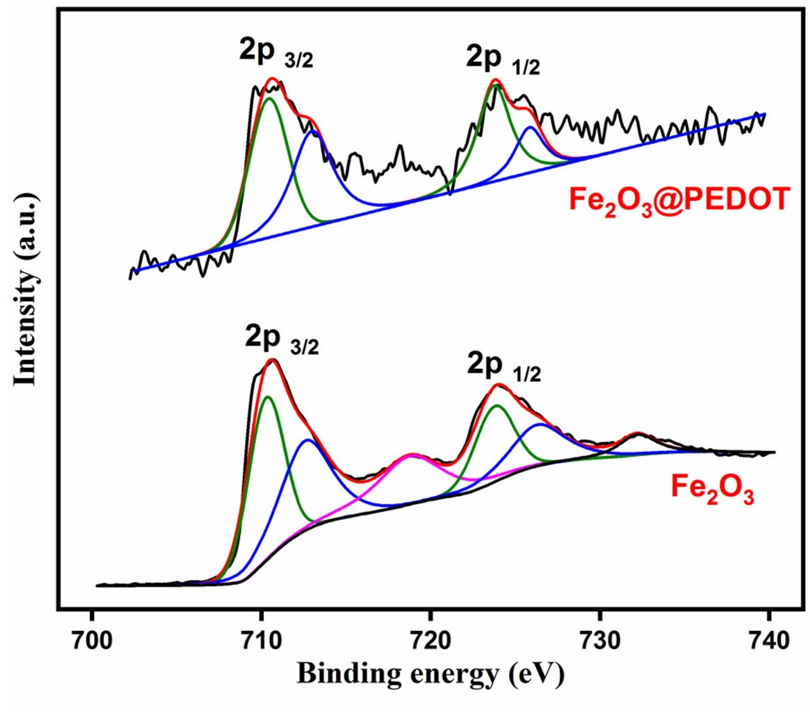


Fig. S5. High-resolution XPS spectra of Fe 2p of α-Fe_2O_3 and α-Fe_2O_3@PEDOT

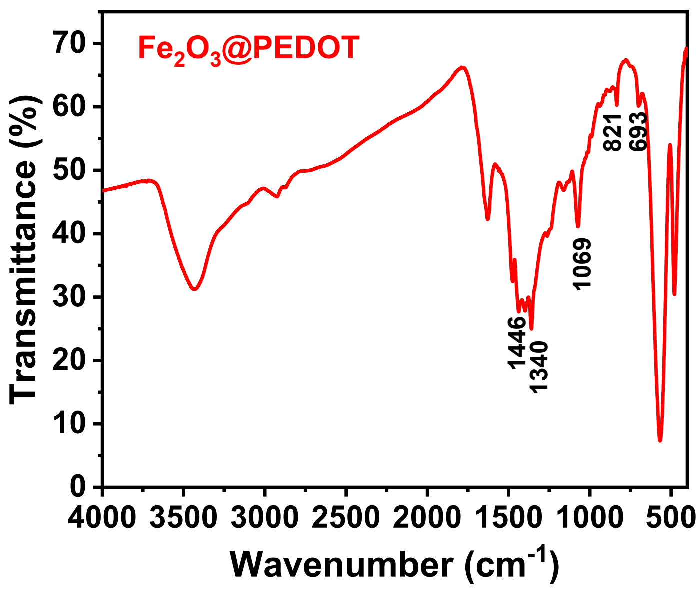


Fig. S6. FT-IR spectrum of Fe_2O_3@PEDOT core-shall nanoparticles from 400 to 4000 cm^{-1}.

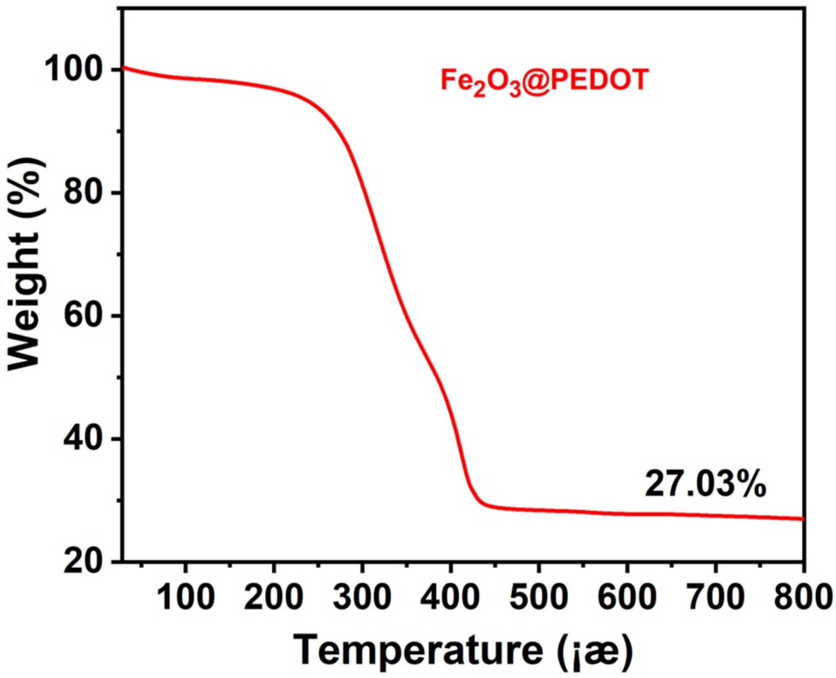


Fig. S7. Thermogravimetric analysis of α-Fe_2O_3@PEDOT sample.

The photothermal conversion efficiency (η_T)

The photothermal conversion efficiency (η_T) was calculated according to the model described previously by Roper's et al.[1, 2] In briefly, (100 μg/mL, 500 mL) of Fe_2O_3@PEDOT was irradiated in a cuvette with NIR laser (808 nm, 1.0 W/cm^2) for 10 min. The temperature was recorded every 30 second. Instantly, the laser was turned off and the temperature was temporally measured until it reached to the ambient temperature.

The equation below was used to calculate the photothermal conversion efficiency (η_T).

$$\eta_T = \frac{hA(T_{max} - T_{amb}) - Q_0}{I(1 - 10^{-A_\lambda})}$$

Where, (T_{max} ,T_{amb}) is the maximum and ambient system temperatures, (A) surface area of the container, (h) is the heat transfer coefficient, (Q_0) the rate of heat input due to absorption of light energy by water, (I) laser power, and (A_λ) the absorbance of the Fe_2O_3@PEDOT at 808 nm. After laser switching off, the cooling curves of Fe_2O_3@PEDOT aqueous solution and water was plotting between ln (ΔT) and function of time, a linear plot yielded with the slope equalling to -1/τs (Fig. 8a, 8b). The (hA) values of Fe_2O_3@PEDOT and water were calculated by the equation below.

$$\tau_S = \frac{m_i C_i}{hA}$$

Where (Ci, mi) are the heat capacity and the mass multiplied for the sample, at that point Q_0 was calculated by water by using the equation below.

$$Q_0 = hA(T_{water\,max} - T_{water\,amb})$$

Finally, we calculate photothermal conversion efficiency (η = 54.3 %) of our Fe_2O_3@PEDOT core-shall NPs.

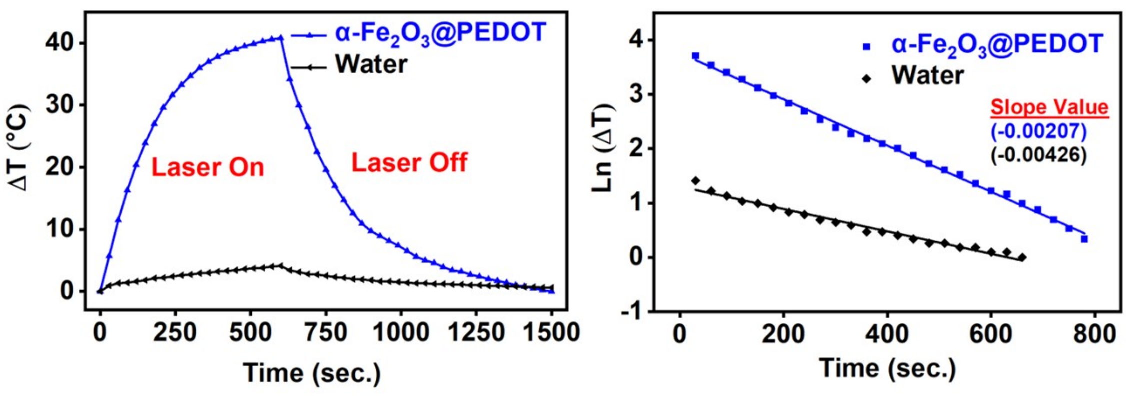


Fig. S8. (a) Heating and cooling curves of α-Fe_2O_3@PEDOT and water irradiated by an 808 nm NIR laser (1.0 W/cm^2). (b) The cooling curves with the fitting of α-Fe_2O_3@PEDOT and water.

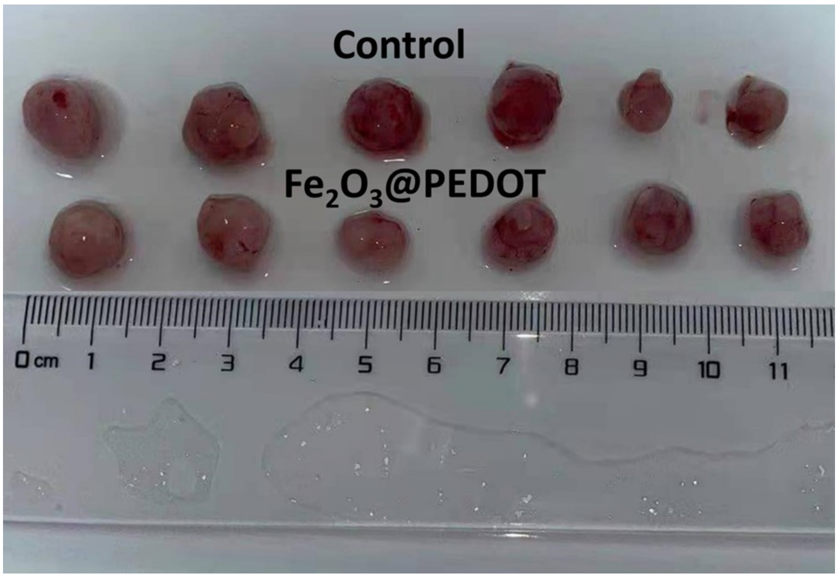


Fig. S9. The mice tumor images of the Fe_2O_3@PEDOT treatment group.

References

1. H. A. Hoffman, L. Chakrabarti, M. F. Dumont, A. D. Sandler and R. Fernandes, *RSC Adv.*, 2014, **4**, 29729–29734.

2. X. Wang, Y. Ma, X. Sheng, Y. Wang and H. Xu, *Nano Lett.*, 2018, **18**, 2217–2225.