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# 1 Iron oxide-carbon core-shell nanoparticles for dual-modal imaging-guided 2 photothermal therapy

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14 **Abstract:** Nanostructured materials that have low tissue toxicity, multi-modal imaging capability and high  
15 photothermal conversion efficiency have great potential to enable image-guided near infrared (NIR)  
16 photothermal therapy (PTT). Here, we report a bifunctional nanoparticle (BFNP, ~16 nm) comprised of a  
17 magnetic Fe<sub>3</sub>O<sub>4</sub> core (~9.1 nm) covered by a fluorescent carbon shell (~3.4 nm) and prepared via a one-pot  
18 solvothermal synthesis method using ferrocene as the sole source. The BFNP exhibits excitation  
19 wavelength-tunable, upconverted and near-infrared (NIR) fluorescence property due to the presence of the  
20 carbon shell, and superparamagnetic behavior resulted from the Fe<sub>3</sub>O<sub>4</sub> core. BFNPs demonstrate dual-modal  
21 imaging capacity both in vitro and in vivo with fluorescent imaging excited under a varying wavelength  
22 from 405 nm to 820 nm and with T<sub>2</sub>-weighted magnetic resonance imaging ( $r_2 = 264.76 \text{ mM}^{-1} \text{ s}^{-1}$ ). More  
23 significantly, BFNPs absorb and convert NIR light to heat enabling photothermal therapy as demonstrated

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