

Supporting Information

Advanced Materials

Fluorescent polystyrene-Fe₃O₄ composite nanospheres for in vivo imaging and hyperthermia

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The laser excitation experiment on QD-MNS was completed at room temperature, and a Nd:YAG pulse laser at 355nm was used to pump the samples. Fluorescence of CdSeTe/ZnS quantum dot was observed at room temperature from the QD-MNS sample (Fig. S1). As shown in Figure S1, the peak of QD-MNS is broad with a maximum around 770 nm. A blue shift can be seen in Fig. S1 as compared with the emission of an isolated quantum dot. For the commercial quantum dot used in this experiment, the maximum fluorescence is at 800 nm, as is also shown in Fig. S1. Due to the inevitable heterogeneous etching of the quantum dot during sample preparation, another peak is observed near 650 nm, which corresponds to the blue shift of the quantum dot caused by particle size variation.

The magnetic properties of the QD-MNS were characterized by using the Quantum Design MPMS-5 superconducting quantum interference device (SQUID) magnetometer. Field-dependent magnetization was measured at 300 K. The sample exhibits a typical hysteresis of a superparamagnetic material (Fig. S2). The magnetization saturates at about 1000 Oe, and the hysteresis is essentially reversible.

The heating rate of QD-MNS was measured using the Hilger's technique. The detailed experimental procedure can be found in ref. 15. The frequency and amplitude of the magnetic field used were 63 kHz and 7 kA/m; respectively. A total of 0.1 ml magnetic fluid that contained 50 mg magnetic nanospheres with an average diameter of 100 nm dispersed in iodinated oil was

placed in a sample container. An optical fiber thermometer probe (FTI-10; FISO Co., Ltd., Canada) was used inside the container for monitoring the temperature change. The temperature of the sample increases almost linearly up to 52 °C for a heating time of 30 min (Fig. S3). The heating mechanism has been attributed to the Néel relaxation behavior, a well established model in hyperthermia.

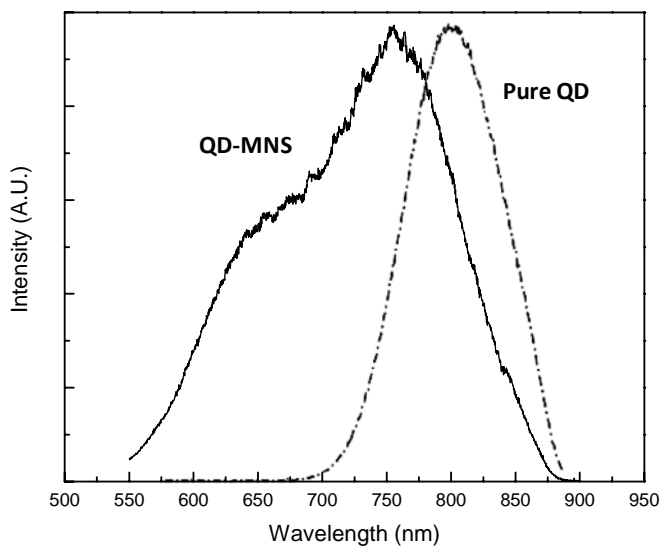


Figure S1 The emission spectrum of the QD-MNS.

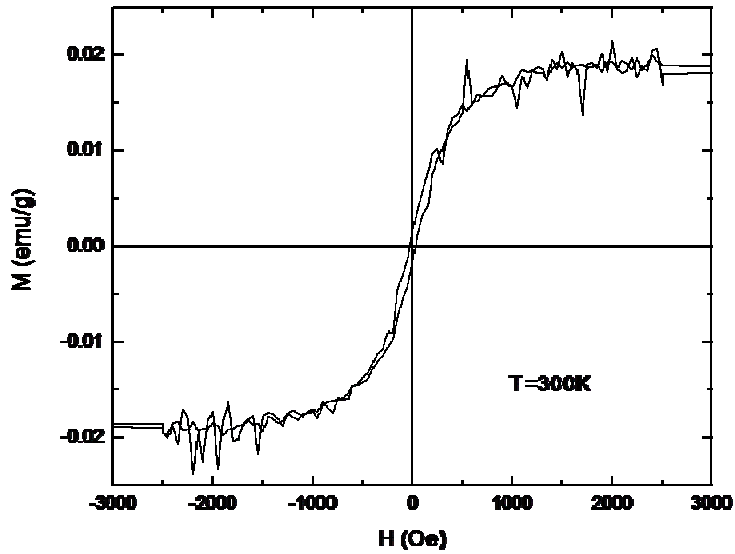


Figure S2 Magnetization vs. applied field for the QD-MNS taken at 300 K.

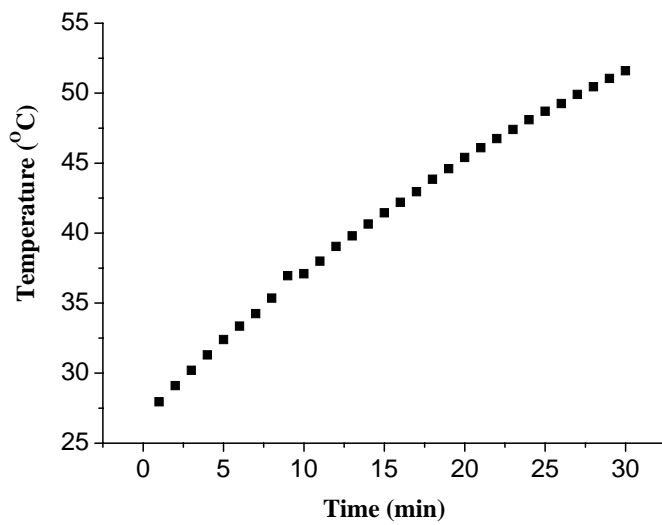


Figure S3 Temperature vs. heating time for the composite magnetic nanospheres.