

## Supporting Information

**Phase and Morphology Controlled in the Synthesis of Iron Oxide Particles:**

**Dimension-based Carbonaceous Materials as Modifier**

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## **Experience section**

### **Chemicals and Materials**

Graphite powder was purchased from national medicine group chemical reagent Co., Ltd. in China. Sodium nitrate, hydrochloric acid, potassium permanganate, sulfuric acid, hydrogen peroxide (30%), barium chloride, 5-Sulfosalicylic acid dihydrate, diethylene glycol, sodium acetate anhydrous and hydroxy propyl cellulose were analytical grade and purchased from Shantou west long chemical Co., Ltd in China. Iron (III) chloride anhydrous (98%) was purchased from Alfa Aesar. All chemicals and solvents were used as received. All aqueous solution were prepared using ultrapure water (18 MU) from a Milli-Q system (Millipore).

### **Synthesis of carbon dots (CQDs)**

In the typical synthesis of carbon dots, 5-sulfosalicylic acid dihydrate (1.0 g) and diethylene glycol (20 mL) were added into three-necked flash. The reaction mixture was heated to 200 °C with a constant heating rate of 5 °C min<sup>-1</sup>, and maintained for 5 min. The brown solution was cooled to room temperature and stored for further used.

### **Preparations of graphene oxide**

Graphene oxide (GO) was prepared according to previous methods.[1] Typically, graphite powder (1.0 g) and concentrated sulfuric acid (23 mL) were mixed and stirred in ice bath. NaNO<sub>3</sub> (0.5 g) and KMnO<sub>4</sub> (3.0 g) were slowly added into the suspensions and kept the temperature at 0±1 °C. After the temperature of solution was increased to 35±3 °C and for 30 min, water (46 mL) was added, the suspensions was heated up to 98 °C and maintained for 15 min, and then water (140 mL) and H<sub>2</sub>O<sub>2</sub>

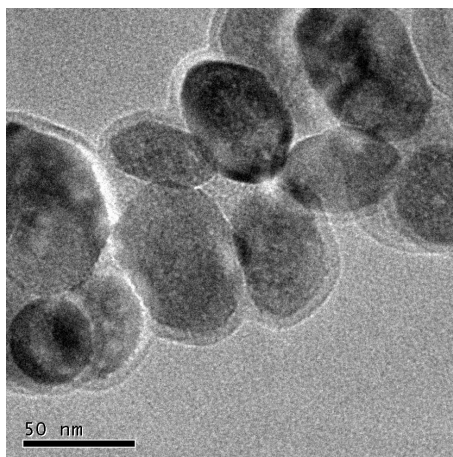
(30%, 2 mL) were added to end the reactions. The suspensions was hot filtered, washed by HCl solution (5%) until no  $\text{SO}_4^{2-}$  in the filtrate can be founded. The products were vacuum-dried at 60 °C overnight and then sealed for the preservation.

**Synthesis of iron oxide nanoparticles:** The precursors for the synthesis of  $\alpha\text{-Fe}_2\text{O}_3$  or  $\text{Fe}_3\text{O}_4$  nanoparticles were ferric chloride (1.0 g), anhydrous sodium acetate (3.0 g) and graphene oxide (25 mg) or ferric chloride (1.0 g), hydroxy propyl cellulose (0.1 g) and anhydrous sodium acetate (3.0 g), which were dissolved in diethylene glycol solution (20 mL) to form a homogeneous solution. For synthesis of heterostructure  $\alpha\text{-Fe}_2\text{O}_3/\text{Fe}_3\text{O}_4$  nanoparticles, ferric chloride (1.0 g) and anhydrous sodium acetate (3.0 g) were dissolved in CQDs dispersive diethylene glycol solution (20 mL, from CQDs prepared procedure) to form a homogeneous solution. The mixture solutions were dispersed by ultrasound for 30 min, transferred into a Teflon-lined stainless-steel autoclave, heated at 200 °C for 6 h, and cooled to room temperature. The products were washed several times with ethanol and water and dried at 80 °C.

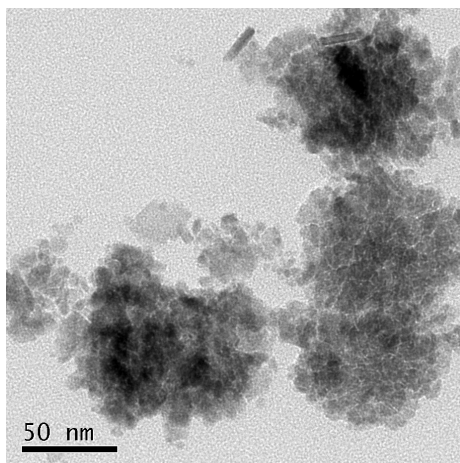
### **Characterizations methods**

The morphology of samples were characterized by scanning electron microscopy (SEM, JSM-6010La) with an accelerating voltage of 10 kV. EDX was used for element analysis. Transmissions electron microscopy (TEM) was obtained with Tecnai G2 20 S-TWIN. UV-vis absorption spectra and Photoluminescence emission spectra were measured on a Hitachi Spectrophotometer and a Hitachi U-3010 Spectrophotometer at room temperature, respectively. The X-ray diffraction (XRD) patterns of all samples were recorded with a D/MAX-TTRIII diffractometer (Rigaku

corporation, Japan) and the data were collected from  $10^\circ$  to  $70^\circ$  ( $2\theta$ ). X-ray photoelectron spectrum (XPS) was carried out on Horiba EMAX7593-H (Japan).



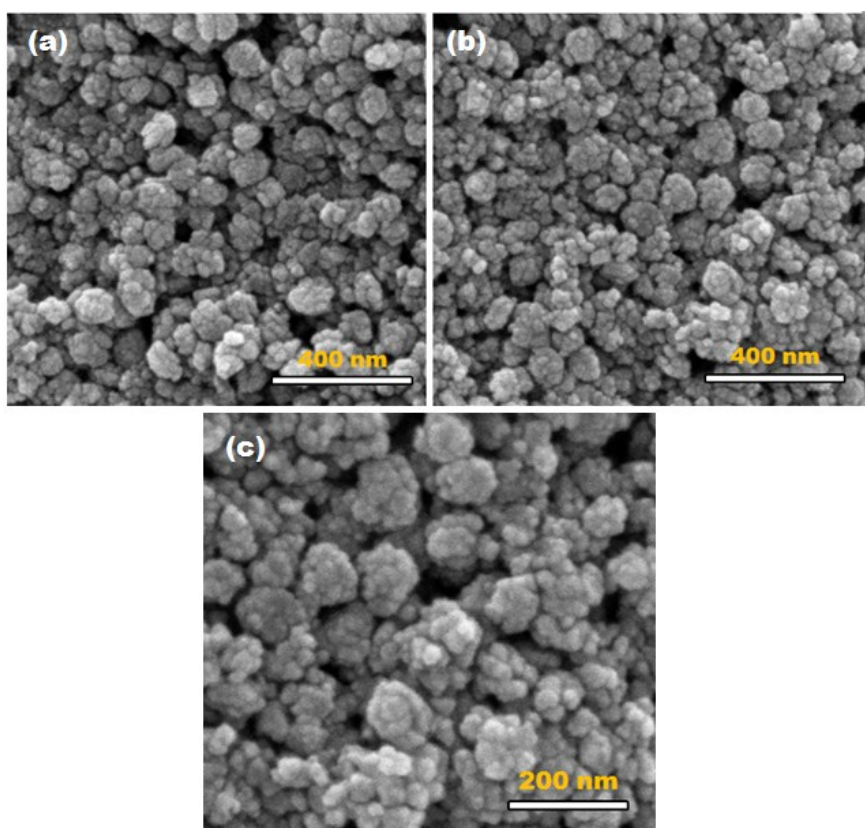
**Figure S1.** TEM image of iron oxide nanoparticles obtained from GO as a modifier.



**Figure S2.** TEM image of iron oxide nanoparticles obtained from CQDs as a modifier.

**Table S1.** BET surface areas of the iron oxide particles prepared from different modifiers.

<b>Samples</b>	<b>Modifier</b>	<b>Morphology</b>	<b>BET surface area (m<sup>2</sup> g<sup>-1</sup>)</b>
$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> @rGO	GO	Platelets	14.5
$\alpha$ -Fe <sub>2</sub> O <sub>3</sub> /Fe <sub>3</sub> O <sub>4</sub>	CQDs	Spherical	59.1
Fe <sub>3</sub> O <sub>4</sub>	Sodium citrate	Selaginella uncinata	146.6



**Figure S3.** SEM image of H/M mischcrystal obtained from CQDs as a modifier at 200 °C for a different reaction time of 3 (a), 6 (b) and 12 (c) h.