Supporting Information

One-step Fabrication of High Performance Tremella-like Fe_3S_4/C Magnetic Adsorbent with Easy Recovery and Regeneration Properties

Xianbiao Wang[1,2], Weiping Cai[1*], Guozhong Wang[1], Zhikun Wu[1] and Huijun Zhao[3*]

[1]*Key Laboratory of Materials Physics, Anhui Key Laboratory of Nanomaterials and Nanotechnology, Institute of Solid State Physics, Chinese Academy of Sciences, Hefei 230031, P. R. China*

[2]*Anhui Key Laboratory of Advanced Building Materials, School of Materials and Chemical Engineering, Anhui University of Architecture, Hefei 230601, P.R. China*

[3]*Centre for Clean Environment and Energy, Gold Coast Campus, Griffith University, Queensland 4222, Australia*

TG and XPS measurements

TG measurement was performed for the Fe_3S_4/C composite with heating rate 5 ^oC/min and nitrogen flow 25 ml/min, as shown in Fig.S1. The weight loss before 160^OC is ascribed to the adsorbed water in the sample. In the temperature range from 160 ^OC-500 ^OC, the weight loss is mainly attributed to decomposition and further carbonization of the carbonaceous materials in the sample, which release CO, CO_2 and H_2O gases, etc.,[S1, S2]. Meanwhile, the Fe_3S_4 is decomposed to FeS_2 [S3], due to the surface-adsorbed oxygen [O], or the reaction

$$3Fe_3S_4 \xrightarrow{[O]} 6FeS_2 + Fe_3O_4 \qquad \text{(S1)}$$

would take place. When the temperature is above 500 ^OC, the FeS_2 is further transformed to $Fe_{1-x}S$ and sulphur [S3], or

$$(1-x)FeS_2 \longrightarrow Fe_{1-x}S + (1-2x)S \qquad \text{(S2)}$$

resulting in a rapid weight loss in the range from 500 ^OC to 560 ^OC owing to evaporation of

* To whom all correspondence should be addressed
E-mail: wpcai@issp.ac.cn; h.zhao@griffith.edu.au

sulphur. The final slight weight loss stage occurs from 560 ^{O}C due to the continuing carbonization of carbonaceous materials.

XPS measurements were conducted for the Fe_3S_4/C composite. The binding energy spectrum of O1s is illustrated in Fig. S2. The peaks at 533.03, 531.37 and 529.71 eV correspond to C-O, C=O and –OH groups, respectively [S4], indicating the existence of functional groups at surface of Fe_3S_4/C composites. Also, the binding energy spectrum of C1s is shown in Fig. S3. The peaks at 284.2 eV, 285.0 eV, 286.0 eV, 287.3 eV and 288.5 eV correspond to C=C, C-C/C-H, C-O, C=O and O-C=O groups, respectively [S4]. Obviously, the C1s signal in Fig.S3 indicates that the hydrophobic groups(C-H, C=C, C-C) account for a decent proportion in total carbon containing groups on the adsorbent's surface.

Both measurements have further confirmed existence of functional groups (C-O, C=O and –OH) at surface of Fe_3S_4/C composites.

References

[S1] C. E. Byrne and D. C. Nagle, *Carbon*, 1997, **35**, 259-266.

[S2] I.C. Lewis, *Carbon*, 1982, **20**, 519-529

[S3] M. J. Dekkers, H. F. Passier and M. A. A. Schoonen, *Geophys. J. Int.*, 2000, **141**, 809-819.

[S4] C.G Chen, B. Liang, Di Lu, A. Ogino, X. K. Wang and M. Nagatsu, *Carbon*, 2010, **48**, 939 -948.

Fig.S1 Xianbiao Wang et al

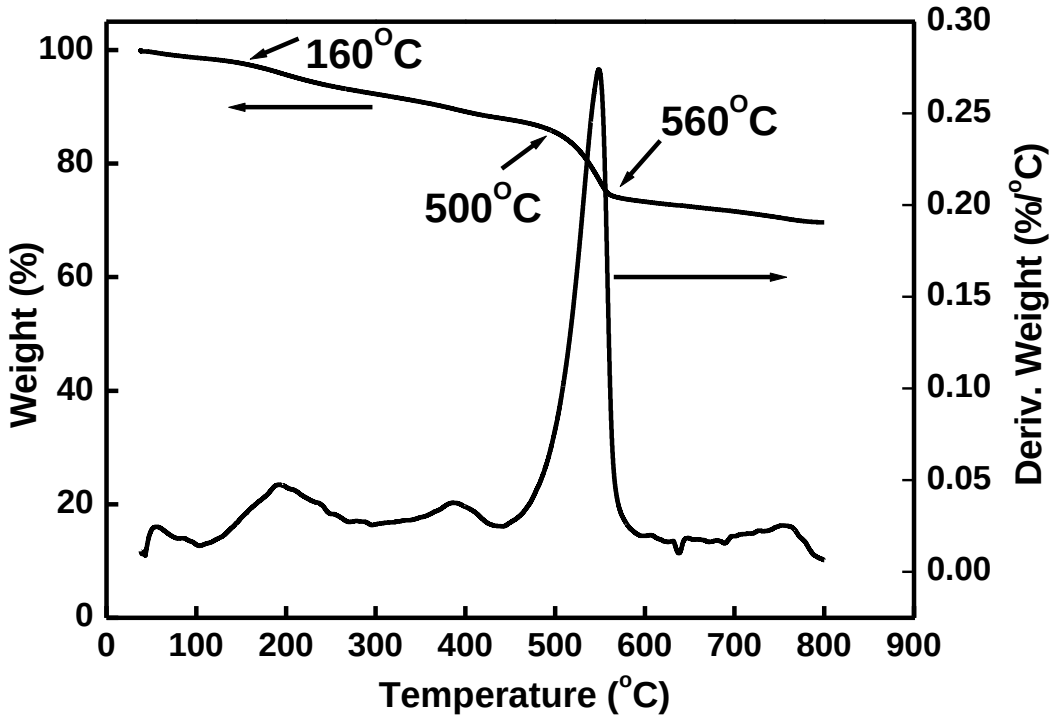

Fig. S1 TG curve of Fe_3S_4/C composite with heating rate 5 °C/min and nitrogen flow 25ml/min.

Fig.S2 Xianbiao Wang et al

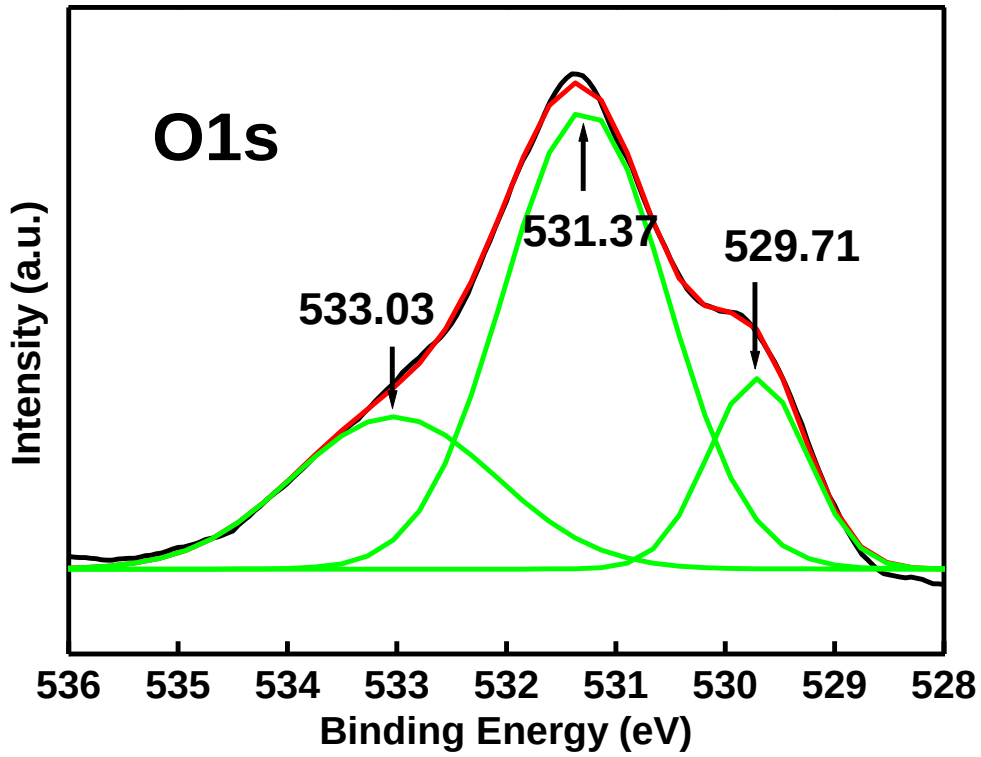

Fig. S2 The binding energy spectrum of O1s in the Fe_3S_4/C composite.

Fig.S3 Xianbiao Wang et al

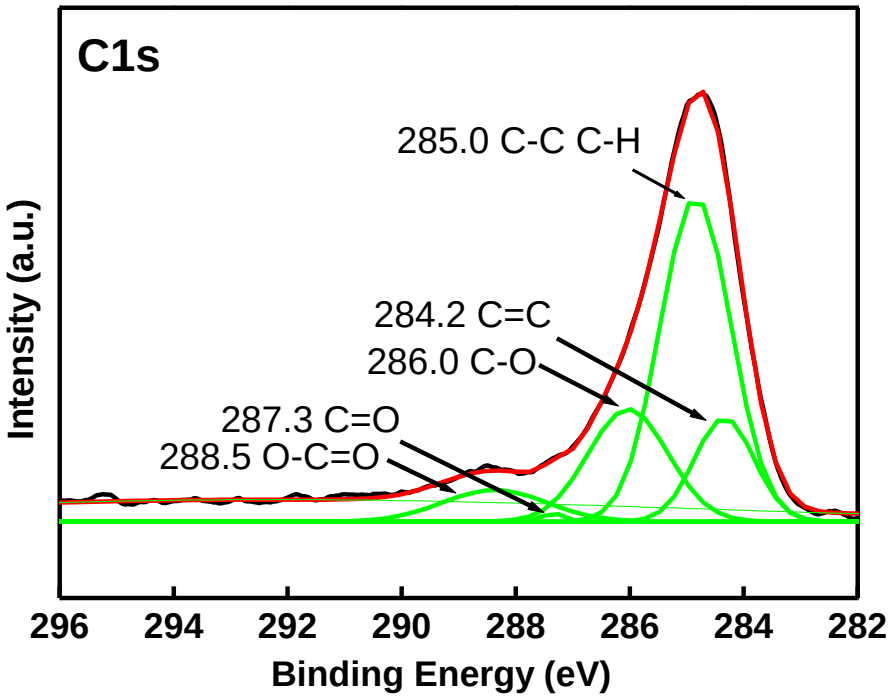

Fig. S3. The binding energy spectrum of C1s in the Fe_3S_4/C composite.

Fig.S4 Xianbiao Wang et al

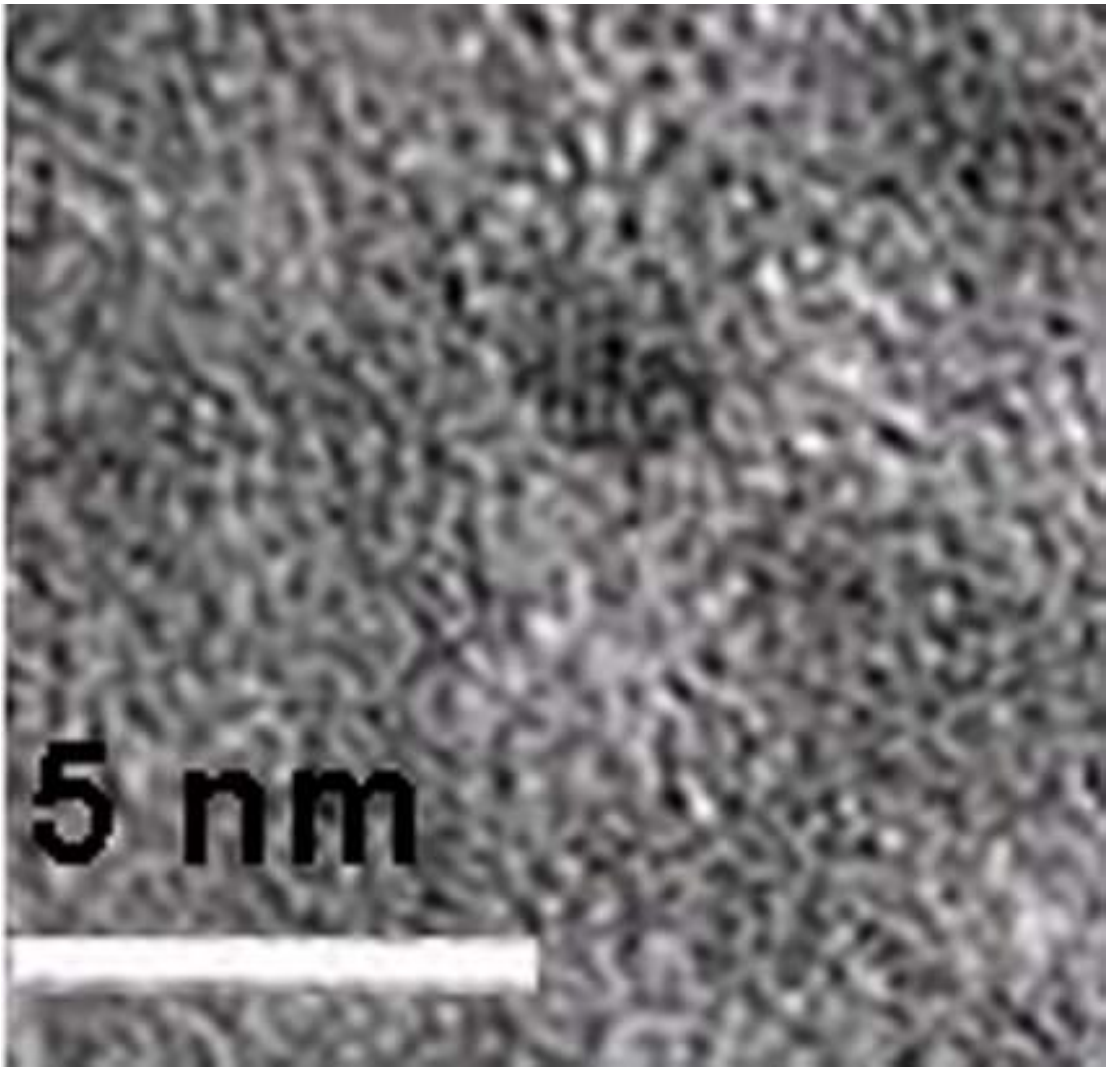

Fig. S4 A magnified area cut from Fig.4(d) in the manuscript (with different contrasts in different areas)

Fig.S5 Xianbiao Wang et al

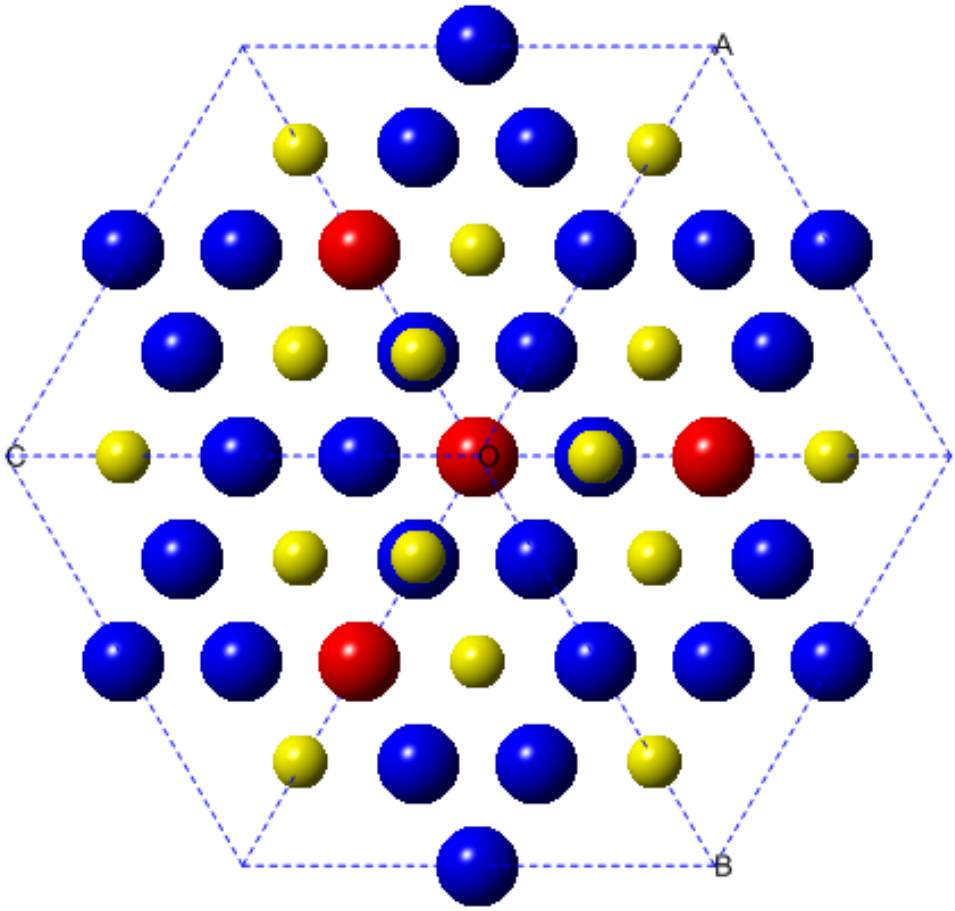

Fig. S5 The schematic atomic structure of the crystal plane (111) (View along [111]).

: Fe^{3+}, : Fe^{2+}, : S^{2-}

Fig.S6 Xianbiao Wang et al

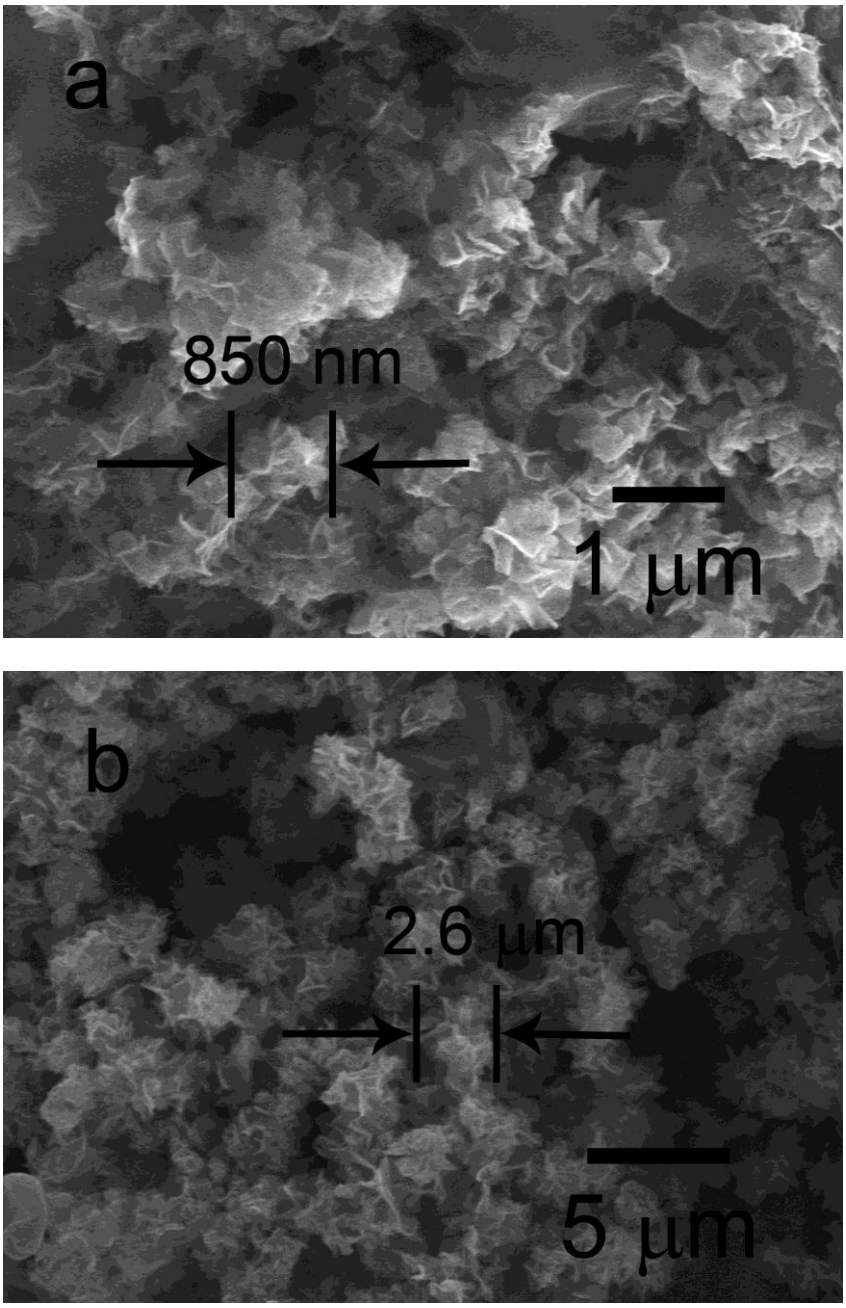

Figure S6. The FESEM images of the as-prepared products after solvothermal reaction for (a) 1 h and (b) 4h.

Fig.S7 Xianbiao Wang et al

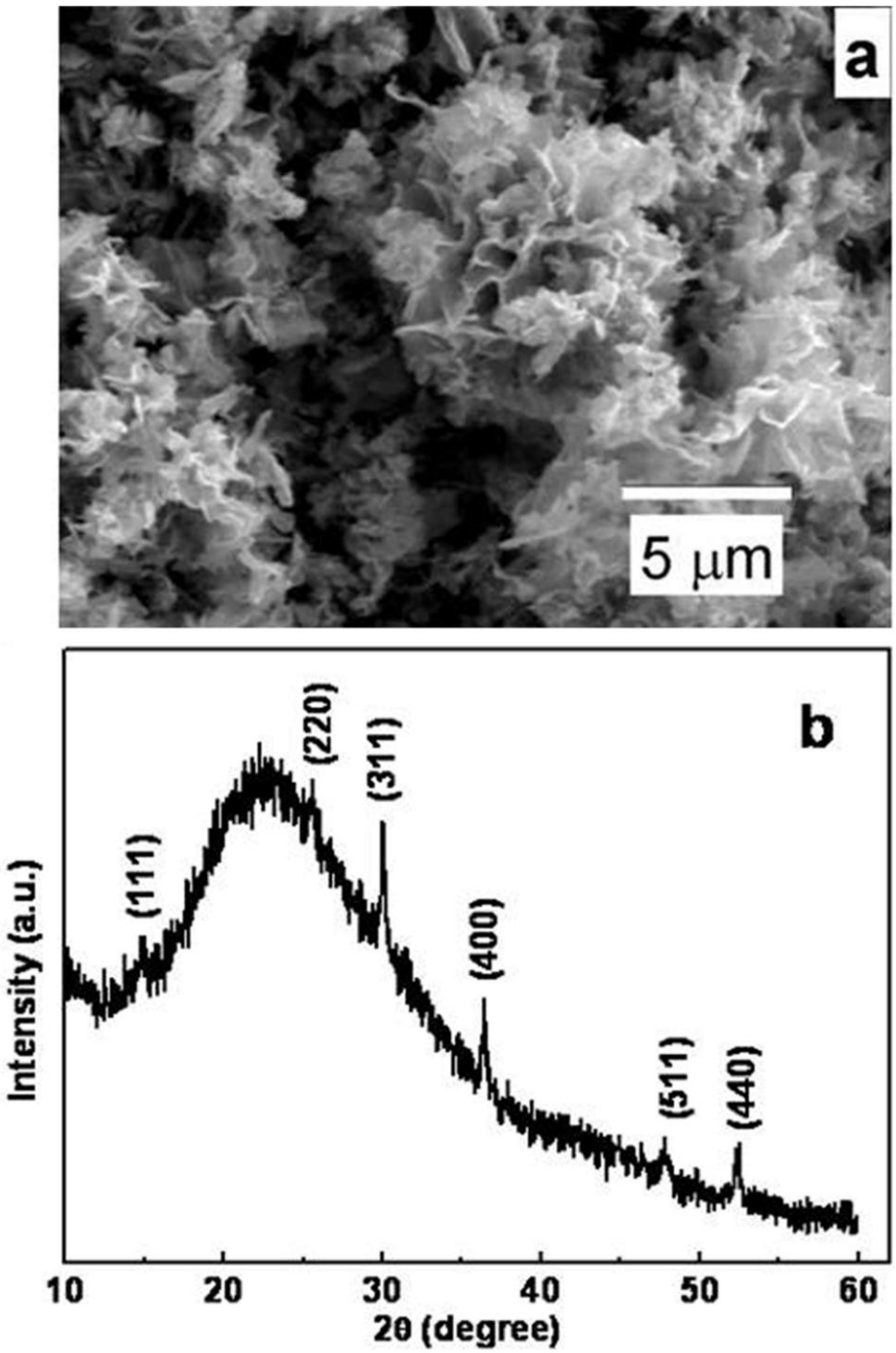

Fig. S7 FESEM image (a) and XRD (b) of the Fe_3S_4/C composites after MB adsorption. (Note: The adsorption experiment was conducted using 10 mg Fe_3S_4/C composites in the 5 ml solution with MB 10mg/L for 10min. After separation from the solution, the composites were washed with deionized water and dried before FESEM and XRD characterization)