Supporting Information

One-step Fabrication of High Performance Tremella-like Fe₃S₄/C Magnetic Adsorbent with Easy Recovery and Regeneration Properties

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TG and XPS measurements

TG measurement was performed for the Fe₃S₄/C composite with heating rate 5 °C/min and nitrogen flow 25 ml/min, as shown in Fig.S1. The weight loss before 160°C is ascribed to the adsorbed water in the sample. In the temperature range from 160°C-500°C, the weight loss is mainly attributed to decomposition and further carbonization of the carbonaceous materials in the sample, which release CO, CO₂ and H₂O gases, etc.[S1, S2]. Meanwhile, the Fe₃S₄ is decomposed to FeS₂ [S3], due to the surface-adsorbed oxygen [O], or the reaction

\[
3Fe₃S₄ \xrightarrow{(\text{o})} 6FeS₂ + Fe₃O₄ \tag{S1}
\]

would take place. When the temperature is above 500°C, the FeS₂ is further transformed to Fe₁₋ₓS and sulphur [S3], or

\[
(1-x)FeS₂ \longrightarrow Fe₈₋ₓS + (1-2x)S \tag{S2}
\]

resulting in a rapid weight loss in the range from 500°C to 560°C owing to evaporation of...
sulphur. The final slight weight loss stage occurs from 560 °C due to the continuing carbonization of carbonaceous materials.

XPS measurements were conducted for the Fe₃S₄/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 Fe₃S₄/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 Fe₃S₄/C composites.

References
Fig. S1 TG curve of Fe$_3$S$_4$/C composite with heating rate 5 °C/min and nitrogen flow 25ml/min.
Fig. S2 The binding energy spectrum of O1s in the Fe₃S₄/C composite.
Fig. S3. The binding energy spectrum of C1s in the Fe₃S₄/C composite.
Fig. S4 A magnified area cut from Fig. 4(d) in the manuscript (with different contrasts in different areas)
Fig. S5 The schematic atomic structure of the crystal plane (111) (View along [111]).

- : Fe$^{3+}$, : Fe$^{2+}$, : S$^{2-}$
Figure S6. The FESEM images of the as-prepared products after solvothermal reaction for (a) 1 h and (b) 4 h.
Fig. S7 FESEM image (a) and XRD (b) of the Fe$_3$S$_4$/C composites after MB adsorption. (Note: The adsorption experiment was conducted using 10 mg Fe$_3$S$_4$/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)