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F F_3 , 31 33 . z / , 31,34 . I , , F F_3• H_2 /G 35 , F $_2F_5$•H_2 /G 36 F $_2F_5$•H_2 / G 37 , IB . H , F F_3•0.33H_2 /C . C 38 39 40 H 41 F F_3 . H , . , 42 . , z F F_3 43,44 . I z / z 45 47 . I z 48,49 . A , 50 . , , (C) 51 53 . , C , 54,55 . F , . C $_2$/ C , 568 A 1 100 A 1 100 56 . . z $_2$@ C , 474.0 A 1 66.7 A 1 50 57 . A , C , IB 58,59 . H , , F F_3•0.33H_2 C . H z F F_3•0.33H_2 / C - . F F_3•0.33H_2 , . I C F F_3•0.33H_2 60 .

2. Experimental

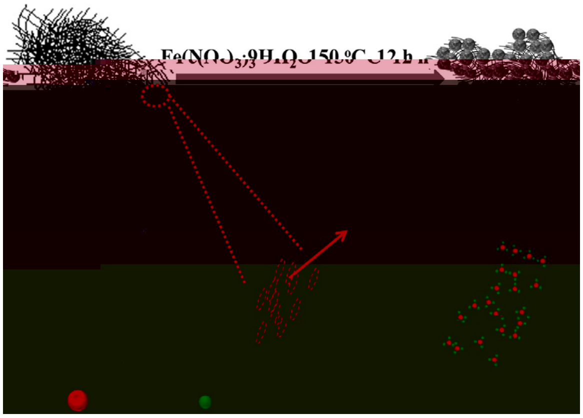
F F_3•0.33H_2 / C z C H_2 4 . K 4, (HF) , (III) (3)3•9H_2) . I , 120 C (10 % F F_3•0.33H_2) 50 L 1.0 L HF 100 L . 1 C F F_3•0.33H_2 . 2.02 F (3)3•9H_2 . A 20 150 °C 12 . , 80 °C 12 . C .

F F_3•0.33H_2 F F_3•0.33H_2 / C z D/ -3C - (D) C / α - (λ = 1.542 Å) 40 A 40 4 ° 1 10° 80° (2θ). F I z F (F I) (E 0.09 1.) . (E , JE L J -6610L) (E , JE L JE -2100F). B E (BE) (II 3020, A) / . z B J H (BJH) .

, (DF) - -2- ( ) 80:10:10. - 10 110 °C 12 . F F_3•0.33H_2 F F_3•0.33H_2 / C , (GF/D) , 1 L 1 C 4 (C). F , 1 . / IB (z C) 1.0 4.0 (. +/). A .

3. Results and discussion

1 F F_3•0.33H_2 / C . F F_3•0.33H_2 C , C- HF . C F 3+ , F F_3•3H_2 61 . A H , ,



Scheme 1. F F_3•0.33H_2 / C

z 62 64. I , . , F^{3+} F , . A , - 27. I - , F F_3•3H_2 F F_3•0.33H_2 - 24. , F F_3•0.33H_2 - z C . D - F . 1( ). I 20° 30°, C 65. A - $2\theta = 13.8°$, 23.6° 27.8°, (1 1 0), (0 0 2) (2 2 0) F F_3•0.33H_2 (, JC D . 76-1262). I z (H B) F F_3•0.33H_2 (F . 1( )) , F - . B , z , z - + 60. , H B-F F_3•0.33H_2 +. C F F_3•0.33H_2 / C F . 2( ). 1343 1580 1

- (D) 2 (G), . A 1612 1 , D′ 66. , I_D/I_G F F_3•0.33H_2 / C (1.80) C (1.62). I_D/I_G F F_3•0.33H_2 C 67. F -I (F . 2( )) C , F F_3•0.33H_2 F F_3•0.33H_2 / C - F F_3•0.33H_2 C . 1620 1 H H F F_3•0.33H_2 . 530 1 F F F F_3•0.33H_2 . 1111 1 F F_3•0.33H_2 / C , C F 68. F F_3•0.33H_2 C .

- - z E . A F . 3( ), C . A F . 3( ), F F_3•0.33H_2 - z 800 . B , F F_3•0.33H_2 z . F F_3•

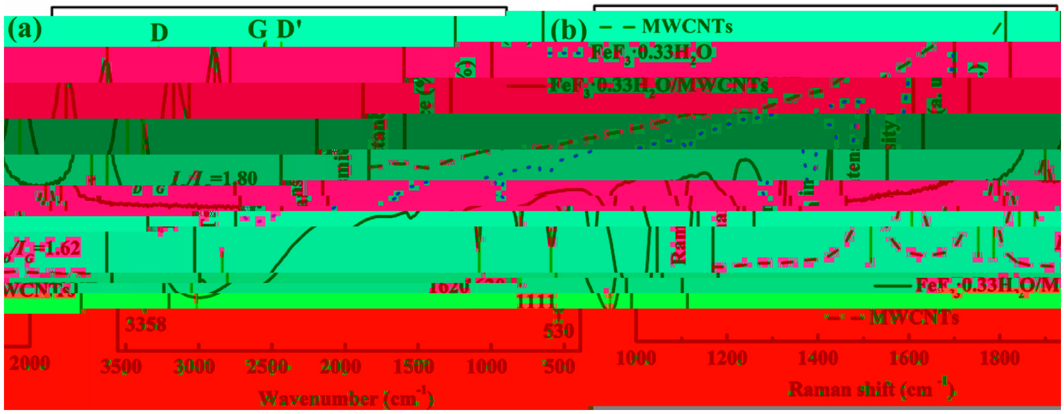


Fig. 2. ( ) C F F_3•0.33H_2 F F_3•0.33H_2 / C ; ( ) F -I C , F F_3•0.33H_2 F F_3•0.33H_2 / C .

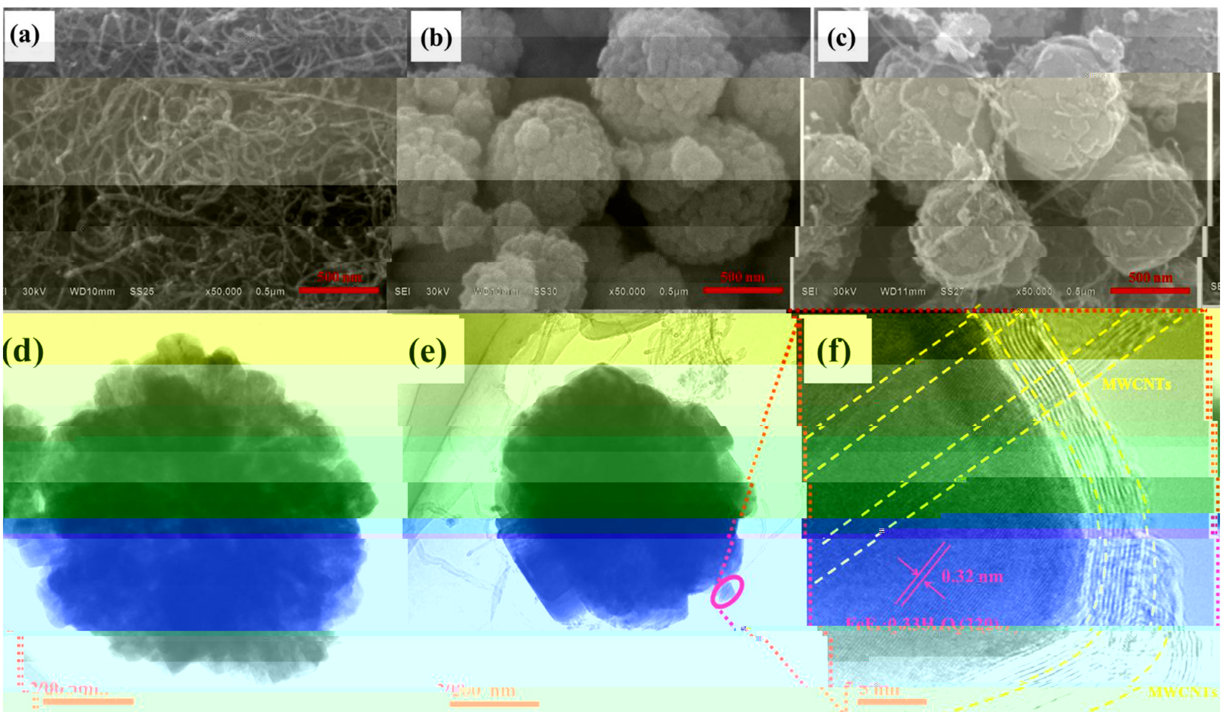


Fig. 3. E ( ) C , ( ) F F_3•0.33H_2 , ( ) F F_3•0.33H_2 / C , E ( ) F F_3•0.33H_2 , ( ) F F_3•0.33H_2 / C , ( ) H E F F_3•0.33H_2 / C .

Table 1. F F_3•0.33H_2 F F_3•0.33H_2 / C .

	BE (2 1)	BJH (3 1)	z ( )
F F_3•0.33H_2	33	0.067	8.4
F F_3•0.33H_2 / C	45	0.18	14.9

F F_3•0.33H_2 F F_3•0.33H_2 / C

/

BJH z . A I AC -

F F_3•0.33H_2 F F_3•0.33H_2 / C

(F . 4( )) . A

1, F F_3•0.33H_2 / C

(44.93 2 1), (0.18 3 1)

z (14.84) F F_3•0.33H_2 .

F F_3•0.33H_2 / C -

/ 62 . A ,

+, 70,71 .

F F_3•0.33H_2

F F_3•0.33H_2 / C 0.1 C (1 C = 237 A 1)

1.0 4.0 (. +/ .) 50

F . 5( ). F / F F_3•0.33H_2

F F_3•0.33H_2 / C ,

10 ,

F F_3•0.33H_2 / C

123.5 A 1 50 . B ,

F F_3•0.33H_2

82.8 A −1 50 . A

F 5( ), F F_3•0.33H_2 / C

350.4 A 1,

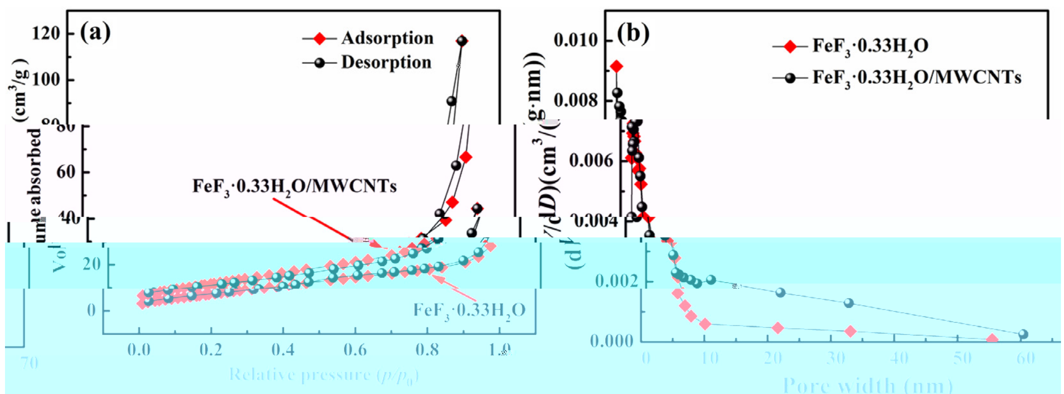


Fig. 4. ( ) 2 . / F F_3•0.33H_2 . F F_3•0.33H_2 / C ; ( ) BJH z F F_3•0.33H_2 . F F_3•0.33H_2 / C .

. . . 294.4 A 1. F F_3•0.33H_2 / C . . . . . 246.0 A 1 . 5 , ... 211.6 A 1 . 10 . . . 163.8 A 1 . 30 . E , . .

Fig. 5. D ( ) F F_3•0.33H_2 ( ) F F_3•0.33H_2 / C (1 , 2 , 10 , 20 , 50); ( ) D . F F_3•0.33H_2 F F_3•0.33H_2 / C 0.1 C; ( ) L 1 C; / ( ) F F_3•0.33H_2 ( ) F F_3•0.33H_2 / C ; ( ) F F_3•0.33H_2 F F_3•0.33H_2 / C .

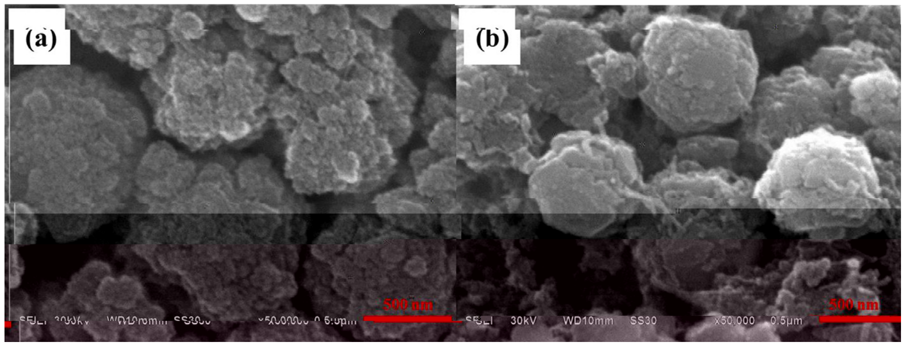


Fig. 6. E ( ) F F_3•$0.33H_2$ ( ) F F_3•$0.33H_2$ / C 50 0.1 C.

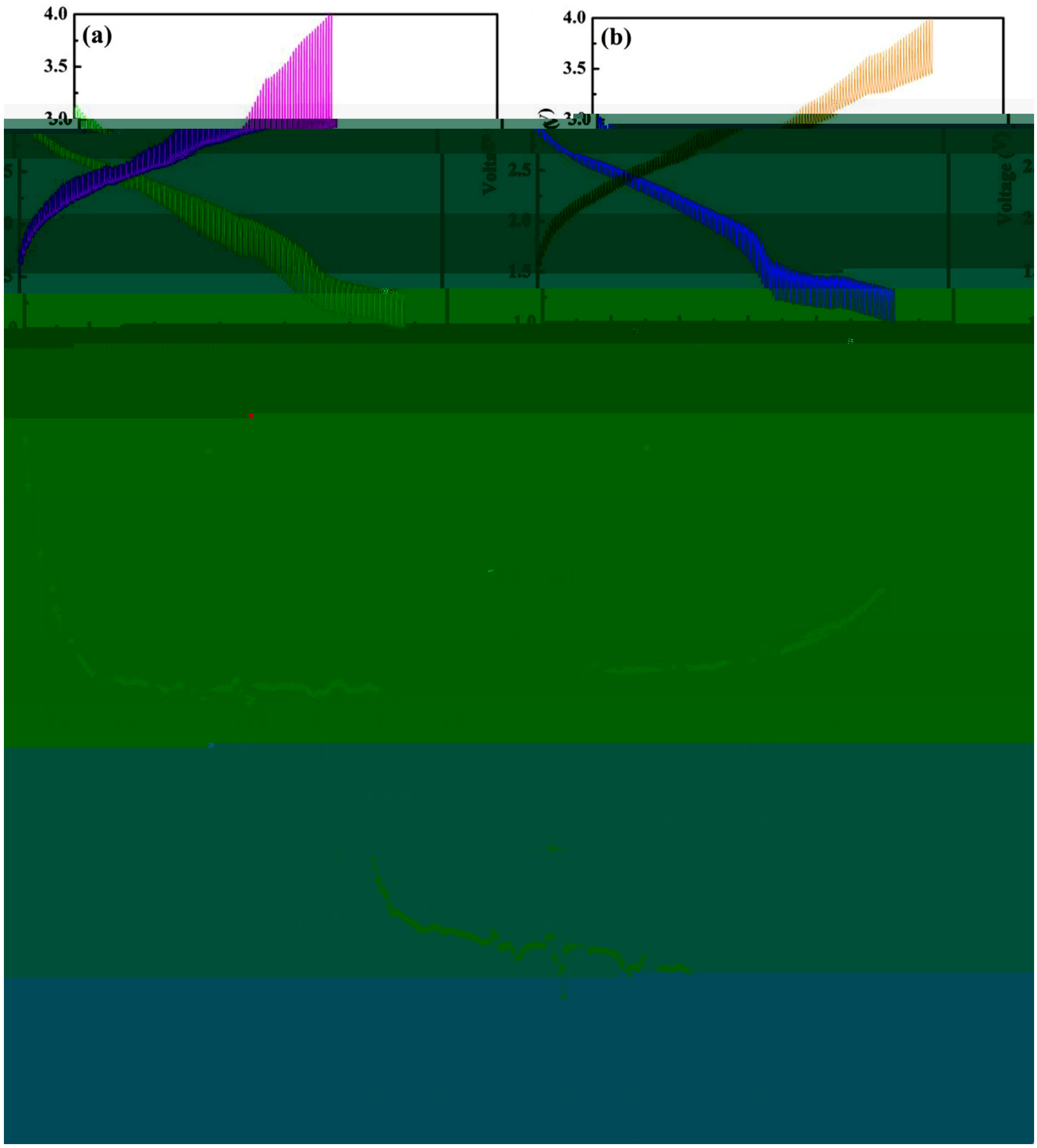


Fig. 7. GI ( ) F F_3•$0.33H_2$ ( ) F F_3•$0.33H_2$ / C 1.0 4.0 ; ( ) , ( ) $^{1/2}$ ( ) F F_3•$0.33H_2$ F F_3•$0.33H_2$ / C .

F F_3•$0.33H_2$ F F_3•$0.33H_2$ / C - A F . 7( ), + - $^{1/2}$ F F_3•$0.33H_2$ 25 : 2.7×10^{14} 6.5×10^{10} 2 10

$$_{+} = \frac{4}{\pi}\left[{}_0 \frac{}{}\right]^2 \left[\frac{}{{}^{1/2}}\right]^2, \quad \ll \frac{^2}{_{+}} \tag{3}$$

F F_3•0.33H_2 / C

+,

. B ,

/ . , F F_3•0.33H_2 / C

, + +

68 .

4. Conclusions

F F_3•0.33H_2 / C

z -

C

F F_3•0.33H_2 ,

F F_3•0.33H_2

z

F F_3•0.33H_2 / C

. IB

F F_3•0.33H_2 / C

350.4 A 1

123.5 A 1 50 0.1 C.

, F F_3•0.33H_2 / C

. A 123.8 A 1

1 C 0.1 C 25

. , F F_3•0.33H_2 / C

IB .

Acknowledgments

F C (. 51272221), K

I H

(. 2016GK4005 2016GK4030).

Supplementary materials

:10.1016/ .2017.10.032.

References

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5 B.L. E I;

63 F. . , H. H , H.B. , C . , .C. ,