Pha e T ar i i r
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Phase transition of CdS in the presence of ethylenediamine and formation of hollow CdS submicron particles with needle-like structure

C , H B *

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, , C , 2– , C 2+ 2 2 3. I , C . , C - C C . I , .

Keywords: ; ; *γ*- ;

1. Introduction

A - (2.5), C 1 5 . I C , . ., , C . A , C , C . A C C 6,7 , 2,8 , C , . ., 9,10 4,11 18 . I C , , 12 18 9 . I , 19,20 . G , C 4,9,11,13,17,19 . I , - - 21 28 . E , - -

*C . E : @ . .

I 0141 1594 /I 1029 0338

D I: 10.1080/01411590802051657
:// . .

24 . C . 24
2 5 -
( ) 140°C,
. I , Z . 27 Z
( ) -
( ) 60°C. H , -
Z , Z 2+, (H4)2 4
, 4°C 27 . ,
Z 27 . I Z
Z , . A C ,
1 3 , -
.
, - C
.
γ-I 29,30 . ,
A
2 33 , 2 34 - -
A - (4-) 35,36 -
. I , γ-
. F , C ( )
37 , C (
C) ( ) 38 . H ,
. I
,
, , C ,
γ- . , C
-
C .

2. Materials and methods

2.1. *Chemicals*

C , ( ) A
. D -

2.2. *Synthesis of CdS submicron particles*

A 4 −1 C 4, 4.2 −1
2 2 3
1.6 −1 . A -
20 , 60C 2 γ-
. 20 G 20 G /
.
A ,
. E
,
60 . ,
.

2.3. *Characterization*

A , ,
. F -
. A ,
(E) (AED)
JE JE -200C 160 , -
E (H E) H 9000
300 , (E)
H -4800
1.0 .
100 . A
, - (D)
′ D C α (λ = 0.15418) -
( ) A
A α . A ,
(D) - I
(JA C -570) .

3. Results and discussion

A , γ- ,
, . .,
( ), H, · H (Eq. (1)) 39 :

$$H_2 \longrightarrow \text{—}, H, \cdot H, H_3^{+}, \bullet\bullet\bullet \quad (1)$$

, , , 2 $^{2-}_{3}$ $^{2-}$ (Eq. (2)) 40 ,
C ( )$_2^{2+}$ C (Eq. (3)).

$$2\ ^{2-}_{3} + \text{—} \longrightarrow\ ^{2-} \quad (2)$$

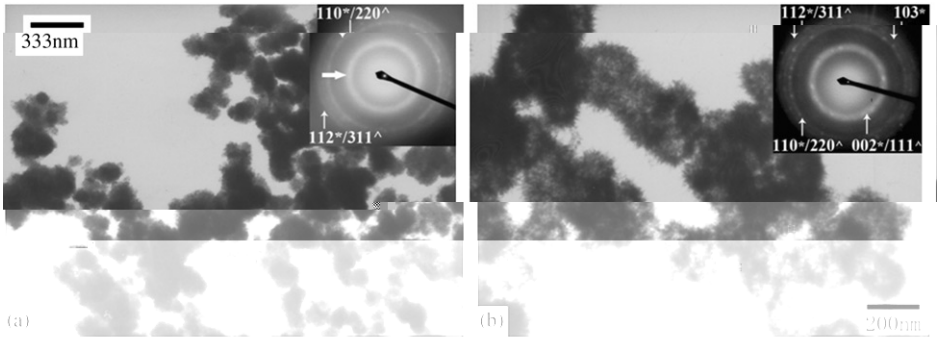
$$[C(\ )_2]^{2+} + {}^{2-} \longrightarrow C \downarrow + 2 \quad (3)$$

F , C $^{2+}$ H_3^{+},
· H (Eq. (4)),

$$\bullet H + H_2\ CH_2CH_2\ H_2 \longrightarrow H_2\ CH_2\dot{C}H\ H_2 + H_2 \quad (4)$$

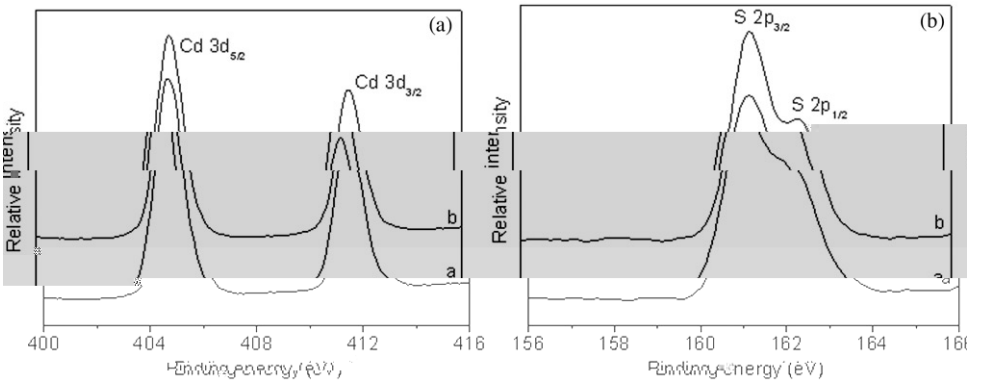
5.5×10^{9} $^{-1}$ $^{-1}$ 39 , · H
$^{2-}$ C .

3.1.

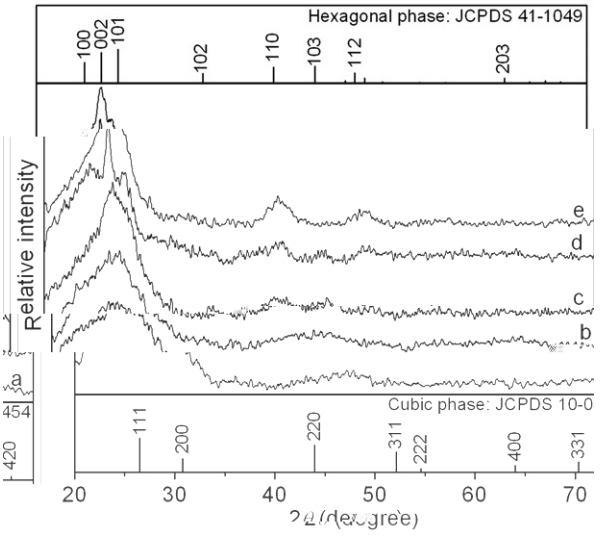


F 1. E ( ) E ( ) (, ,) (,) .
: AED ,
* C ,
C . (A : 20 G , : 20 G /).

(F 1( ))
,
5 10 . (F 2)
2 3/2, 2 1/2, C 3 5/2 C 3 3/2 161.29, 162.46, 404.96
411.73 , , 41 ,
C .
I D (F 3), (102), (110),
(103) (112) , C ,
. H , C
(110) (112) C (220)



F 2. - C 3 ( ) 2 ( ) ( ) ( ) .
: A : 20 G , : 20 G / .



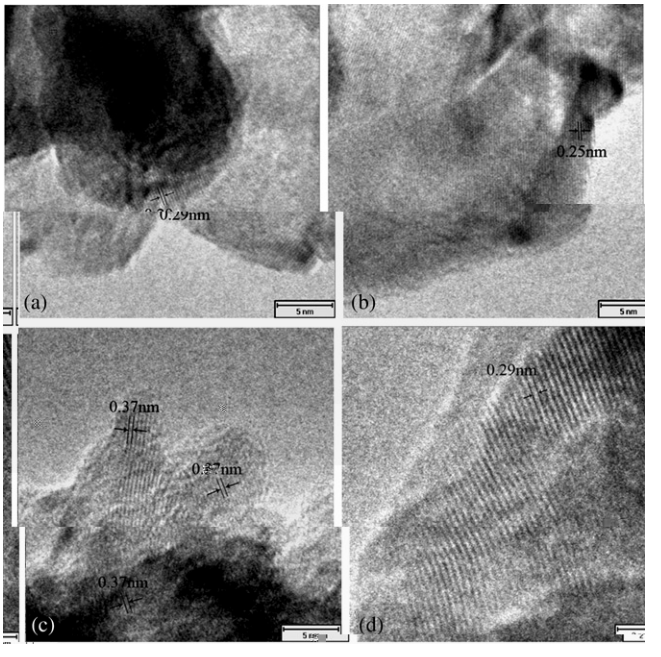
F 3. D : ( ) 3 G , ; ( ) 9 G , ; ( ) 20 G , ; ( ) 20 G , ; ( ) 9 G , .
: D : 20 G / .

(311) C , . I ≈27.3° (002) (101) C , (111) C . C . AED (, F 1( )) (F 1( )) , (110) (112) C (220) (311) C . C . H E - F 4( ) ( ) 0.29 0.25 , (200) C (102)

C , ,
C . , ,
C .
A ,
, C .

3.2. *Formation of hollow CdS submicron particles with needle-like structure*

E (F 1( ))
, . A
,
(F 1( )), E
(F 1( )). (F 2)
C . A F 3 ( ), /
C , (100), (002)
(101) C , (111)
C D - . I AED (,
F 1( )), , (103)
C , . ,
, ,
(002) C (111) C .
C .
A H E (F 4( )),
0.37 , (100) C ,

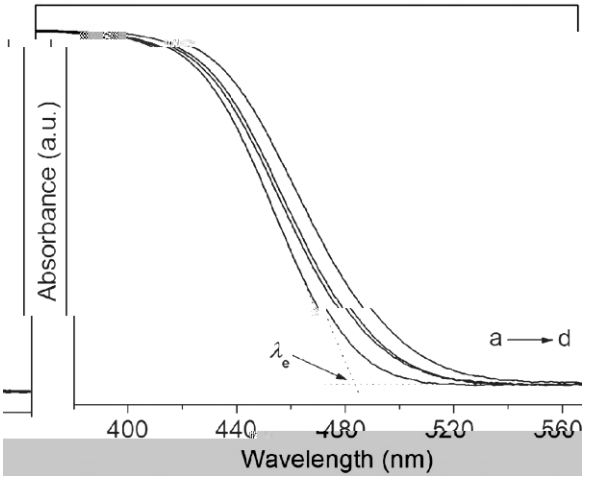


F 4. H E (,) (,) .
: A : 20 G , : 20 G / .

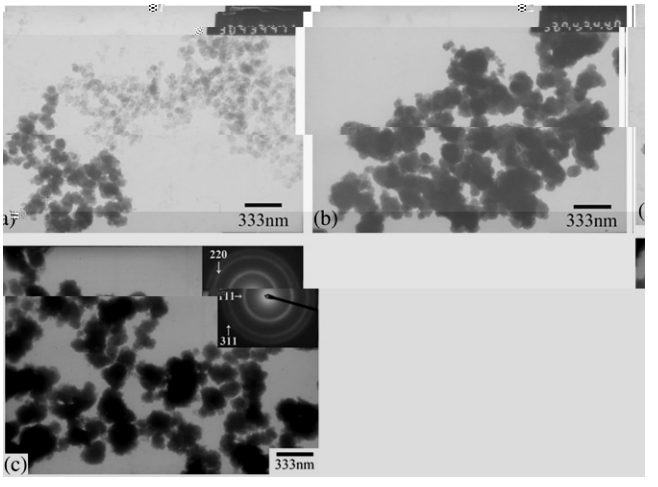
- .
, C (F 4( )). I
. C ≈27.3°
D (F 3) -
AED (, F 1( )),
C , C , C .
I ,
.
60°C,
24 (, I-1). ,
.

3.3. *Effects of the absorbed dose*

B ,
C . A
3 G , C , (λ) ≈483 ,
(F 5).
9 20 G , λ - ≈494
500 (F 5), . A
λ C 42 ,
C 5.0, 5.7 6.2
3, 9 20 G , . H , E (F 1( ), 6( ) 6( ))
, C
. E
(F 1( )).



F 5. :
( ) 3 G , ( ) 6 G , ( ) 9 G , ( ) 20 G .
: D : 20 G / .



F 6. E : ( ) 3 G , ; ( ) 9 G , ; ( ) 9 G , .
: AED . (D : 20 G /).

3 G , ≈27.3° 46.6°, C , D (F 3). 9 G , , (F 3). E , ≈27.3° 20 G (F 3). F , AED ( ) C 3 9 G . , C C .

3.4. *Phase transition of amorphous CdS under different conditions*

, C 9 G 24 . , D , C , ( ). , , C C . , C 20 G . , C 60 . , C , C D (F 3). H , (100), (101) (103) , C , . C , AED (, F 6( )). E (F 6( )) C - .

3.5. *Formation mechanism of hollow CdS submicron particles with needle-like structure*

A , C
- ,
, C , .
Z 43 2 ,
2 , .

, 43 . ,
, 43 .
H , C . I
, . B
C 2+ C ,
. , C ,
C 38 . ,
C . ,

C , - .
, C
C 38 . , ,
C , . C
,
C -
.

4. Conclusions

, , C ,
2–
C 2+ ,
C
2 2 3·
. , C
- C

C ,
. .
A , -

,
- .

Acknowledgements

Z ( ) G Z (B) E
E , H (B) D .
D J ( ) D ( )
γ- .

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