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(12)

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(73) 가 가
2 2 3

(72) 2 2-3 가 가
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2 2-3 가 가

(74)

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(54)

2 (20), 1 (2) . (2) . (5) (7), (9) (W) (Ta) . 2 (12) (6) 2 (12) 2 (6) 2 (20) 1 (2) (6) . 가 , (12) (12) (12) 2 (6) 2 (1) (20) (1, 2) , (9) .

1	1
2	1
3	2
4	2
5	2
6	2
7	2
8	2
9	3
10	3
11	3
12	3
13	

< >
 2 : 1
 5 :
 6 : 2
 7, 9 :
 8 :
 11 :
 12 :
 13 :
 20 : 2
 30 :
 51 :

가

가

가

(Cu)

(ㄱ ㄴ)

가

MOS

MOS

가

13
(104),

(108)

(105), 2)

(108)
가(101),
(101)

1

(2)

(101) 1 (102) , 1 (103)
 , (105) 2 (106) , 2 (107)
 . 1 (102) 2 (106) 2 (107)
 , (104), (105) . , 2 (102) 2 (106)
 , (105) , 2 (106) (106) 1
 (101), (105) . 1 (104), 2
 (108) (101), (105) . , (103) 2 (107)
 , (101), (106) . 1 (103) , 2 (107)
 (102) 2 (105) , , ,
 が .

, (101), (105) 1.21×10^{-7} /K ,
 1.67×10^{-5} /K , 가 , ,
, , , ,
, , , ,
, 1 (103), 2 (107) , , 2 (106) 1
(102) (102) 2 (106) , 가 , 가 , ,
1 , 2 (107) , ,
106) 1 (102) Ti/TiN/Ti 3 2000-183064 , 13 1 (106)
, (Ti)

, 1 , 1 , 1
 2 , 1 , 2 , 2 , 1
 , 2 , 2 , 1 , 2
 , 2 , 1 , 2
 , 2 , 1 , 2
 , 1 , 1 , 1 nm
 (b-1) (a) (c) , (a) 1
 , (c) , (b-2) , (b-2)
 , 2 , 1 ,
 , (b-1), (b-2)

1 , 2 (6) (11) 1 1 , (2) (12) 2
 (20) 2 2 (20) 2 2 (6) 2 (6) 2 (6) 2 (20)
 (9) 가 (9) (5) (12) (51) 2 () 가
 2 (6) 가 , (20) 1 (2) 1 (2) (7) , 2 (8)
 2 (6) (20) 1 (2) 1 (2) (7) , 2 (9) 가 1nm
 20) 1 (2) (7) (8) 2 (6) . 3 8
 《 2》 1
 3 (1) (40)) , , , (40) 가 , 1 (2)
 (3) 1 (3) (40) TaN PVD , CVD (40) 1 (3) CVD
 10nm 1 (2) PVD , CVD , , 1 (2)
 (40) ,
 (1) (1) (40)) , , , , , , , ,
 1 (2) (40) , 1 (4) (5) , (5) (11) (12) (52) 가 (30)
 , 1 (4) (51) , (51) (11) (11) (2) (7) 1 (20) (7) 1 (8),
 가 , 1 (3) (5) , (51) , (7) 2 (20) (7) 6 (20)
 , 5 (9) , , , , , , , , , , , , , ,
 , (7), (8), (9) 가 () 2 (20) , , , , , , , ,
 (7), (8), (9) (8)/ (8) (9) (7, 9) , , , , , , ,
 1 , , , , , , , , , , , , , , , , , ,
 2 (20) (7), (8), (9) (51), (30) , (60) PVD , CVD , 7 ,
 , 2 (60) , , , , , , , , , , , , , , , ,
 (20) (30) , , 1 CMP (2) , (60) 2 (30)
 2 (6) , 8 , , , , , , , , , , , , , ,
 8 (5) , , 2 (52) , (10) 2 (6) 1 , 2 (20) 2 (20)
 , (10) , , 2 , , , , , , , , , , , ,
 , 2 , , , , , , , , , , , , , , , ,
 가 2 , (20) , 2 , (7), (20) , (8), (9)

(57)

1 , , 1
 1 , 2
 ,
 2 ,
 .

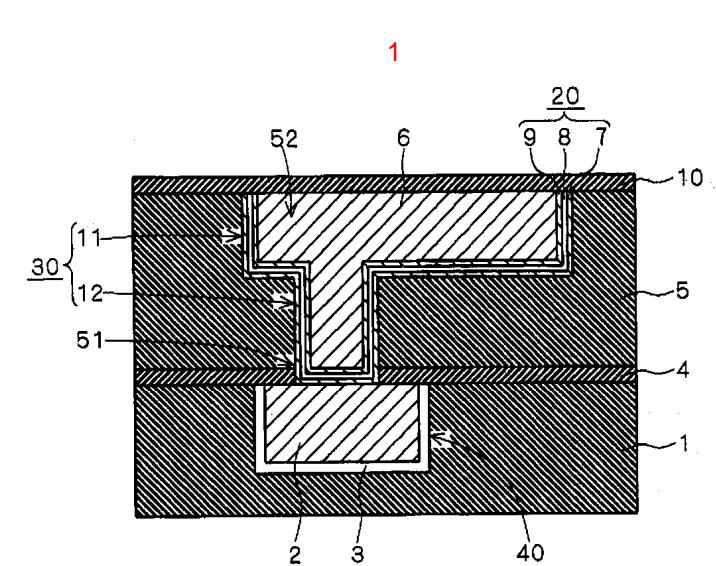
2.

- (a) 1 , , ,
- (b) 1 , , ,
- (c) 2 , , ,
- (b-1) (b) , (a) , , ,
- (b-2) (b-1) , (a) , , ,
- (c) 2 , 1 , , ,

3.

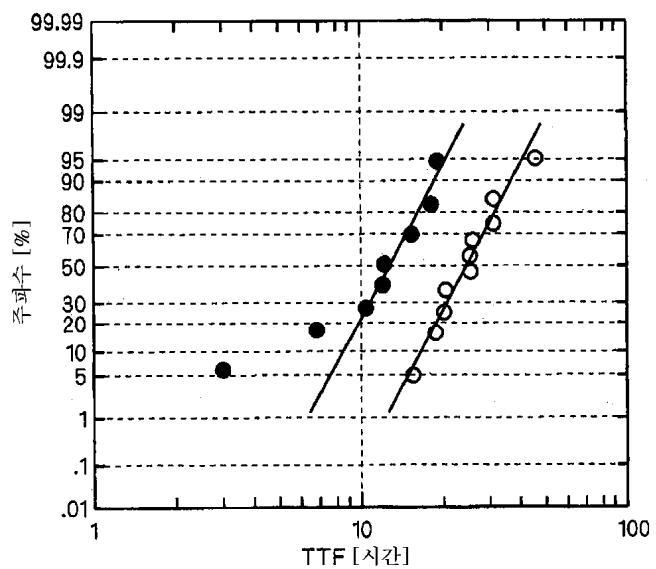
1 , , 1
 1 , 2
 ,
 2 ,
 .

1 , , ,
 1 , 2 ,
 1 , , ,

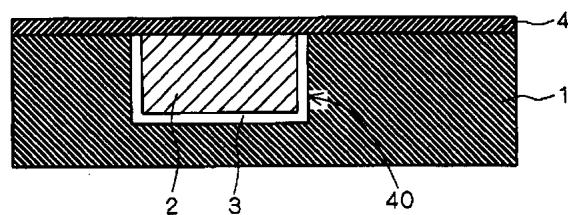


- 2 : 제1 구리 배선
- 5 : 층간 절연막
- 6 : 제2 구리 배선
- 7, 9 : 금속총
- 8 : 금속 화합물총
- 11 : 흄
- 12 : 접속 구멍
- 20 : 제2 도전성 배리어총
- 30 : 판통 구멍
- 51 : 개구

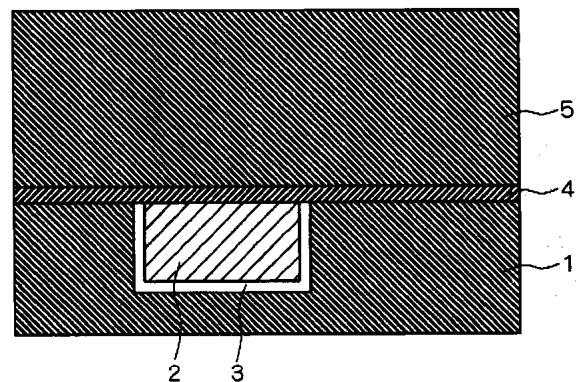
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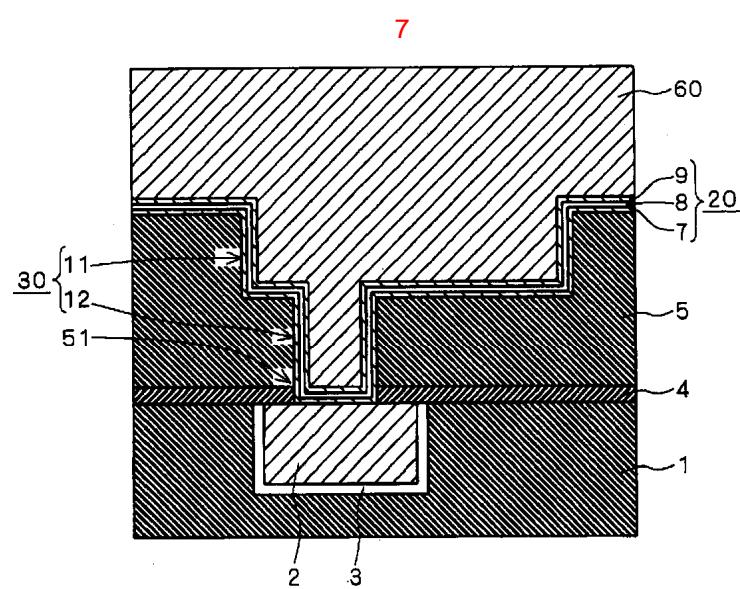
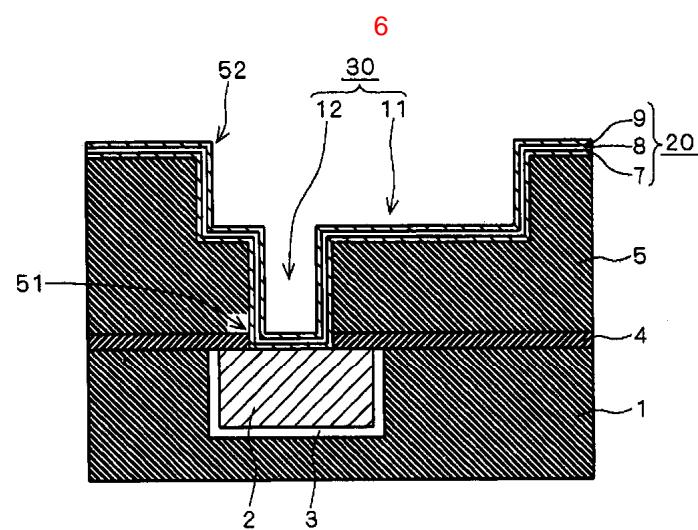
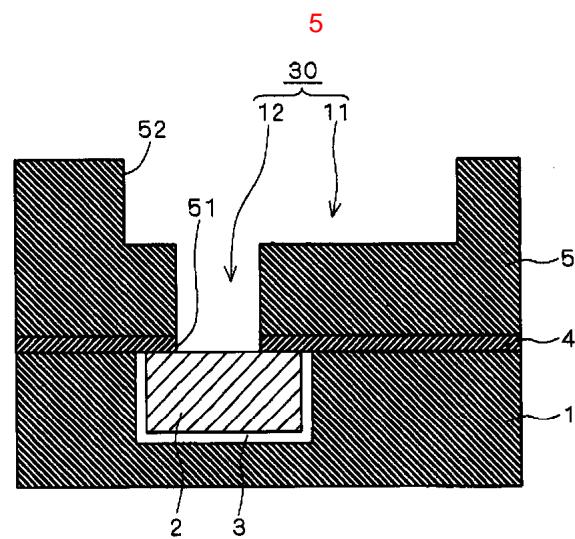


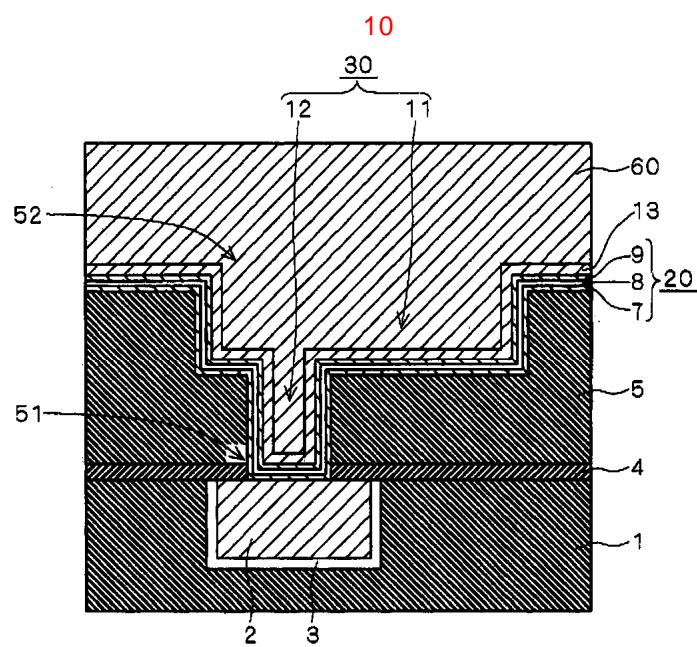
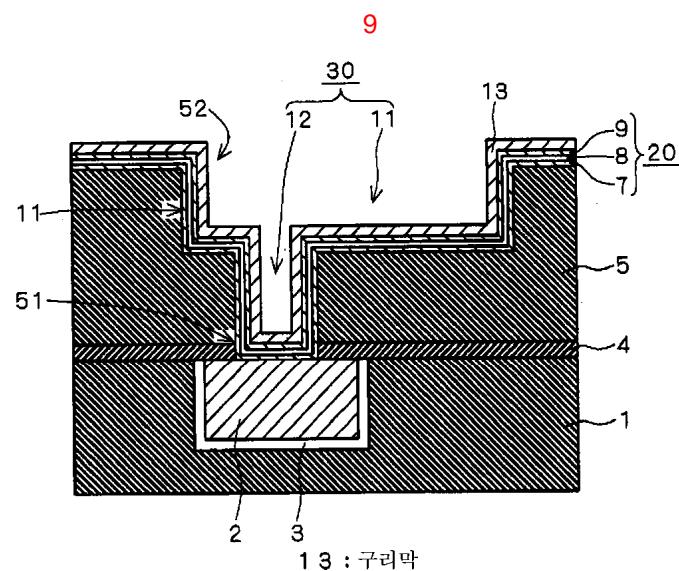
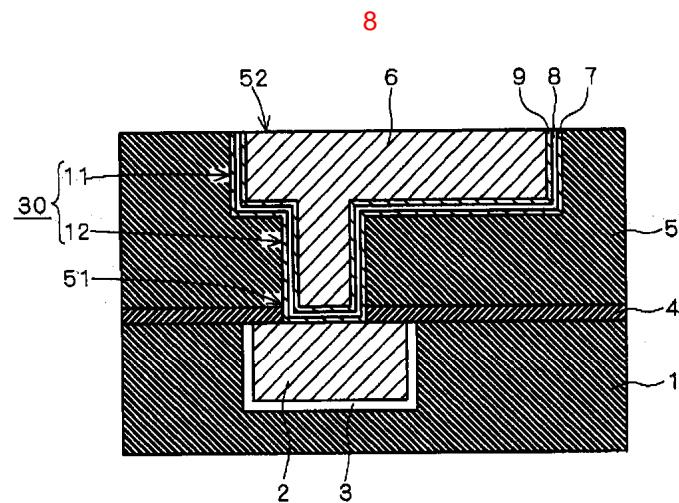
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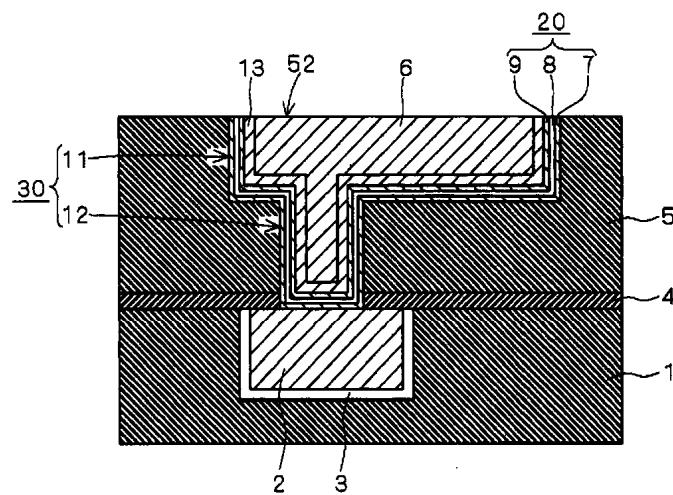
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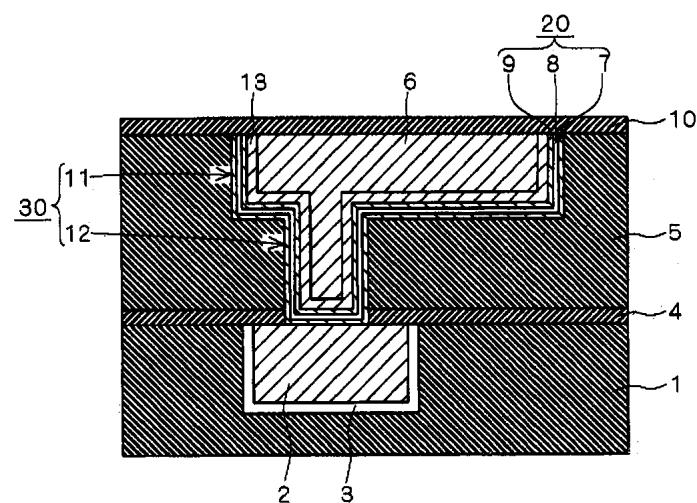




11



12



13

