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2004 03 31(21) 10-2002-0004093
(22) 2002 01 24(65)
(43)10-2002-0087338
2002 11 22

(30) JP-P-2001-00144957 2001 05 15 (JP)

(73) 가 가 2 2 3

(72) 2 2-3 가 가
2 2-3 가 가
2 2-3 가 가

(74)

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(54)

2 (20) , 1 (2) (5) (7), (

8), (9) (W) (Ta) . 2 (6) (12) , 2 (20

) 1 (2) (6) 가 , (12) 2 (6) , (1

1) 2 (6) 가 , (12) 2 (6) , 2

(20) (1, 2) , (9) . (12) 2 (6) 2

1

, , , , ,

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
(Cu)
MOS MOS
가
13 (104), (105), 2 (108) (101), 1 (101) (2
(108)) 가 ()

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

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

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

2 (b) (b-3) 1
(b-3), (b-2), (b-1)

2

2

(b) (c) (d)

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

《 1》

1 1 (1) (40) (1) (4) 0)가 (1) (40) (3) 1 (1), 1 (3), 1 (2) 1 (2) (51)가 1 (4) 1 (4) (5) (30) (12) (1) (11) (11) (1) (51) (30) (12) (30) (51) 1 (4) 2 (51) (20) (6) (11) 1 (30) (51) 2 (6) 1 2 (51) (51) (30) (11) (52) 2 (6) (5) (5) 2 (20) (6) (20) (5) 2 (10) (4), 2 (10) (1), (5) (5) 1 (3) (1) (1) (7), 2 (8), (9) (20) 1 (2) (5) (7, 9) (8) (TiN) (W) (Ta) (7, 9) (7, 9) (7, 9) 가 W WN , Ta TaN 2 (8) 2 (6) (12) (12) 2 (20) 1 (2) (6) (12) (12) (12) 2 (6) 2 (20) (9) 가 (2) (6) 2 (20) 1 (7) 2 (TTF: time to failure) , 가 2 (106) 1 (107) (6) 가 2 (20) 10nm Ta (7) 5nm Ta (9) 10nm Ta 2 가

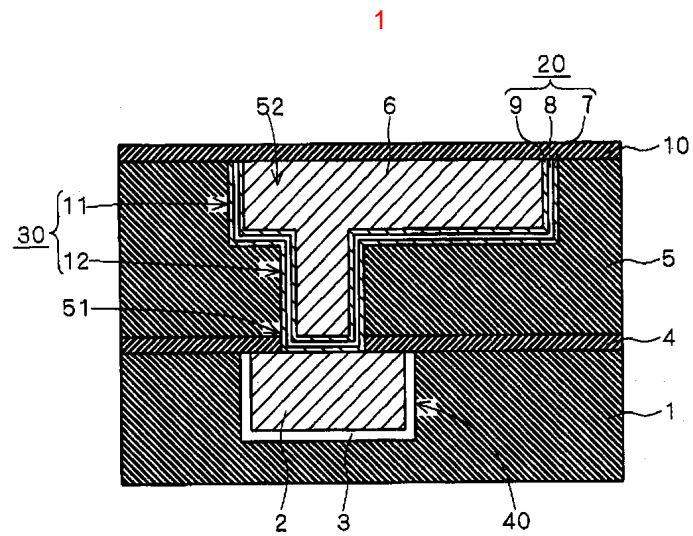
1, 2 (6) (11) 1, (12) 2
 1 (20) 2 (20) 2 (20) 2 (20)
 (9) 가 (9) 2 (6) 가 (20)
 2 (6) 가 (5) (12) (51) 2 (가
 , 2 (20) (9) 2 (6) (8)
 , 2 (6) (20) 1 (2) (7) , 2 ((20) 1 (2) (7) (2) 1 (2) (2) (7) (9) 가 1nm
 《 2》 2 (20) 2 (6) (9) 3 8
 3 (1) (40)가 , 1 (2)
 (3) (40) 1 (3) 1 (2)
 10nm 1 (2) PVD , CVD 1 (2)
 (40)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

《 3》
9 가 12 5
가
(7), (8), (9), 1
가 2
(7), (8), (20) 2 가 2
(9) (13) (9)
9 가
(13) (60) (5)
1), (30) 2 (60) , 10 가 (60) 2 (20)
(30) 가 , (13) (30) (30) 2 (6)
CMP 가 11 (52) 2 (6) 2 (20)
(13) , (5) , 2 (10) 12
가 (9) (13) (9) ,
(13) (9) , 2 (6) 2 (60) (1
3) , 2 (6) (13)
가
(7), (8), (9), 1

(57)

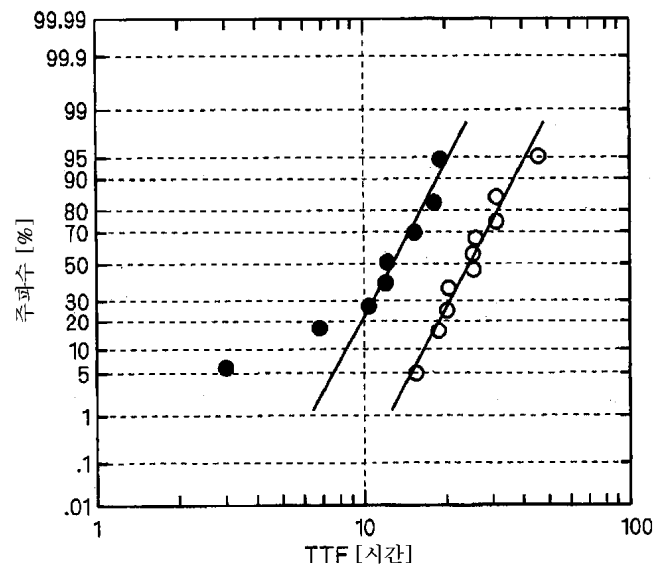
1.

1
1 , 1 2 2 2 ,
1 , 2 1
.
2.
(a) 1 ,
(b) 1 ,
(c) 2
,
(b) , (a) ,
(b-1) ,
(b-2) 1 ,
(c) 2 1 ,
1
3.
1 , 1 2 2 2 ,
1 , 2
,
2 1 ,
1 2
1 가

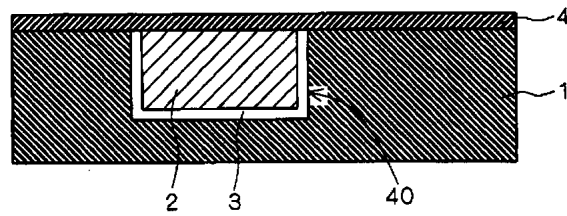


- 2 : 제1 구리 배선
- 5 : 층간 절연막
- 6 : 제2 구리 배선
- 7, 9 : 금속층
- 8 : 금속 화합물층
- 11 : 홈
- 12 : 접속 구멍
- 20 : 제2 도전성 배리어층
- 30 : 관통 구멍
- 51 : 개구

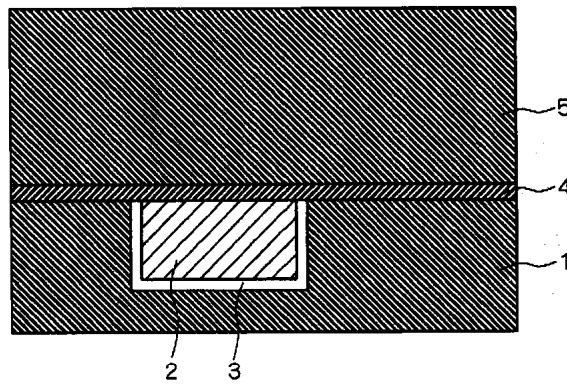
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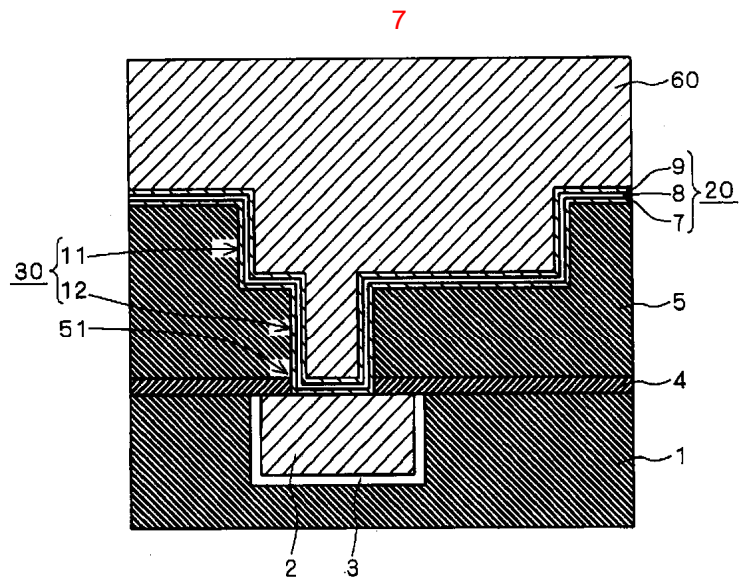
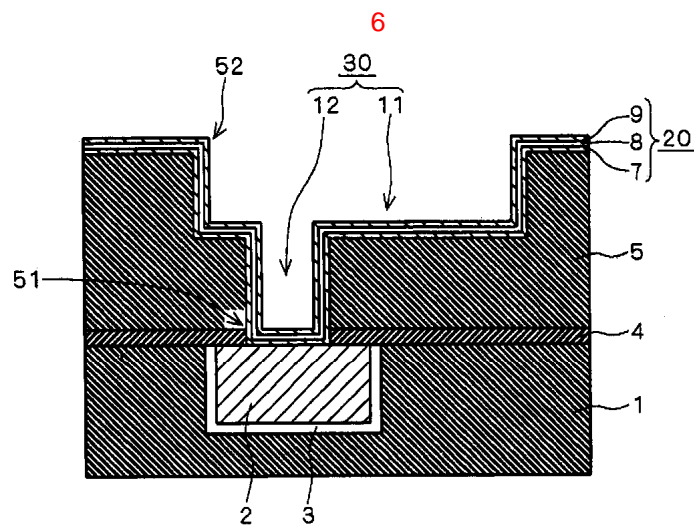
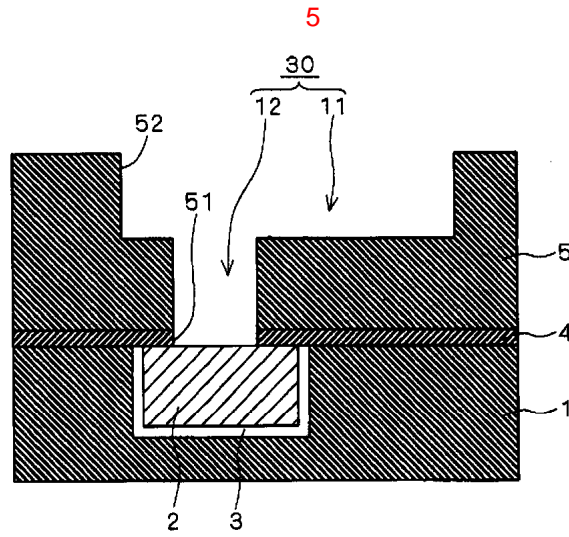


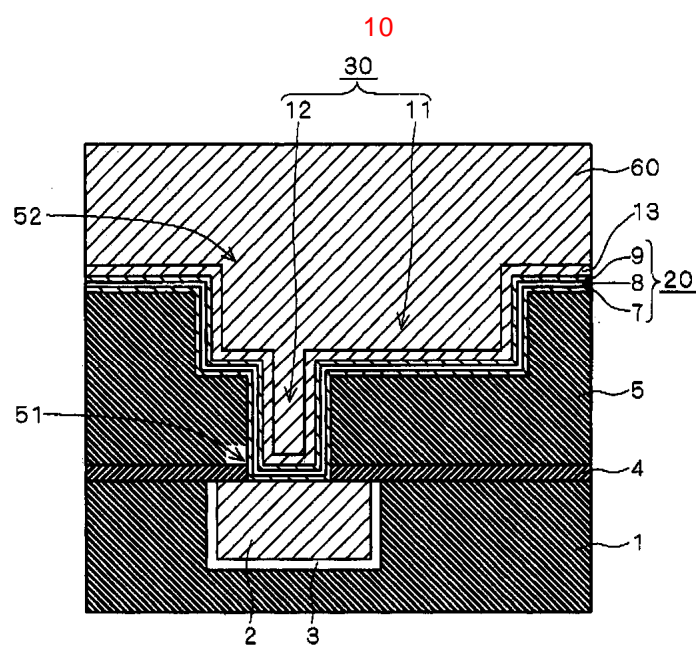
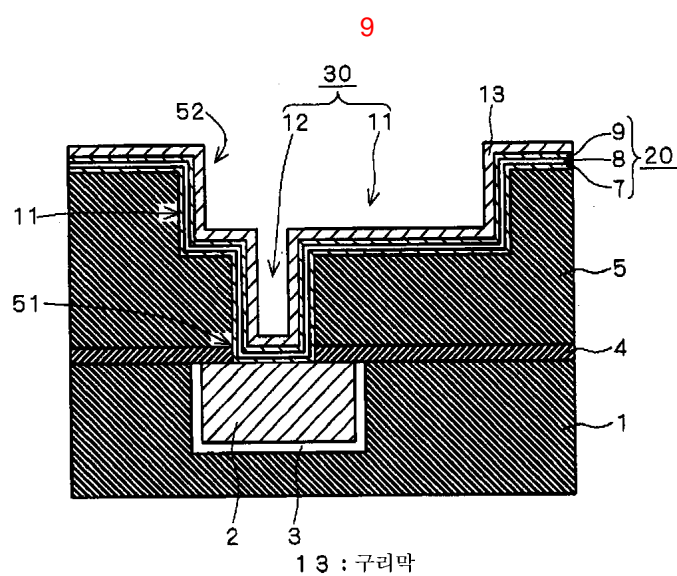
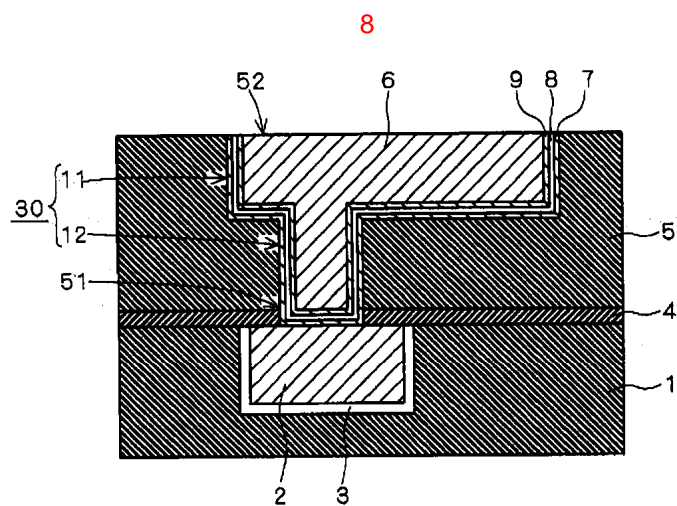
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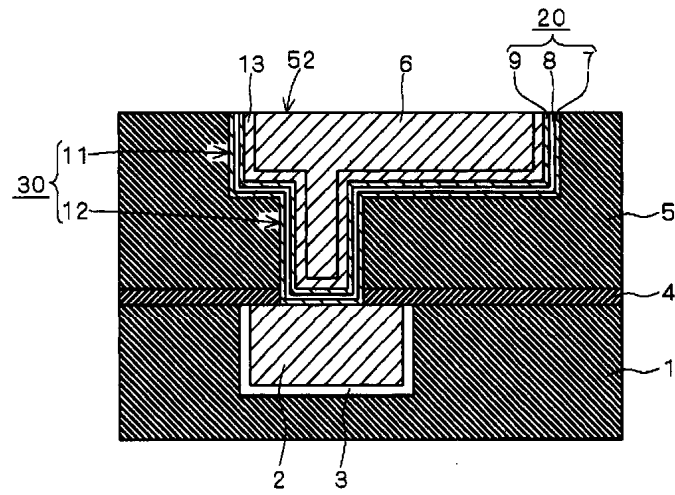
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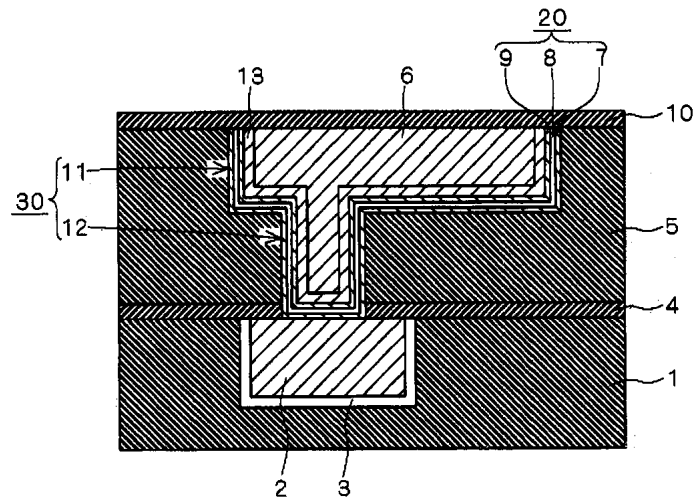




11



12



13

