

(19)  
(12)(KR)  
(A)(51) 。 Int. Cl. <sup>7</sup>  
G11B 5/39(11)  
(43)2002 - 0095037  
2002 12 20(21) 10 - 2002 - 0009042  
(22) 2002 02 20

(30) JP - P - 2001 - 00177925 2001 06 13 (JP)

(71) 가 가  
가 4 6

(72) 가 가 가 785

가 가 6 - 1

가 가 880

5 - 16 - 2 - 1

(74)

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(54)

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2	.		
3	.		
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6	.		
7	.		
8	.		
9	.		
10	.		
11	.		
12	.		
13	.		
14	.		
15	.		
16		1	.
17		2	.
18		3	.
19		4	.
20		5	.
21	.		
22	.		

23

24

25

10 :

101 :

11, 46 :

12 :

121 :

13 :

131 : 1

132 : 2

133 : 1

134 : 2

14 :

15 :

151 : 1

152 : 2

154 :

35 :

36 :

37 :

40 :

41 :

411 :

412 :  
413 :  
414 :  
415 :  
416 :  
42 :  
43 :  
44 :  
45 :  
50 :  
63 :  
64 :  
71 :  
711 :  
72 :  
721 :  
73 :  
83 :  
84 :  
90 :  
91 :  
92 :  
93 :  
94 :  
95 :

USP5408377

가

7 - 73416

MR

가

7 - 169026

( )

가

10 - 173252

가

10 - 284768

가

11 - 259824

가

가

, , 가 , 가  
 , , / / / , /  
 , 가 , 가  
 가 가 가 가  
 (specular effect) Synthetic ferrimagnet 가  
 가

가

(magnetizing)

가

(magnetostatic energy)

가

0.2

0.1 $\mu$ m

가

가

가

가

가

/

/

가

가

가

(感磁)

가

가

가

가

가

가

가

가 , , .

가 , , 가 , , .

가 , , , , . 가 , , .

가 . / , , / / , , .

가 , , Fe<sub>3</sub>O<sub>4</sub> , Fe, Ni, Mn, Co , Ni - 75 85Fe, Co - 1 12Fe, Co - 2 15Fe, 1 30Ni, Si, Ge, 1nm

가 , , .

[illegible]



MnIr, NiMn, Co, Fe, Ni, MnPt, Fe-O, 20at%, 1, 80, 270, 3, M, nPt, MnPt, 가, LLG(Landau Lifshitz Gilibert), (14), (11), (15), (12), (13), (15), 1, (151), 2, (152), (154), 1, (151), 2, (152), 가, 1, (151), 2, (152), 가, (15), 2, 4, 2, (13), 1, (12), 가, 2, Co, NiFe, (10), (13), (45), (10), (13), (411), (412), (413), (37), 45), (37), (411), (13), (412), (411), Ta 1nm, Ru, Cu, (10), (412), 가, (412), (10), (13), 가

(45) , (10)  
 , (412) (13) 가 , (13) (412)  
 , 가 가 , (13) (412)  
 가 (412) 가 .

1 , (13) (45)  
 , 가 ,  
 (15) , .

2 , 2  
 , (50) (35), (71)  
 , (10) , (72), (36)  
 (43) , (40) (10)  
 , 가 (40)  
 , 가  
 (10) 1 가 2

(14), (11), (15), (12), (13)  
 , , (15) 1 (151) 2 (152), (154)  
 , (154) 1 (151) 2 (152)  
 가 , 1 (151) 2 (152)  
 , (15) , 2 4  
 , (13) 1  
 2 , (13) 2  
 , (12) 가 Co  
 , NiFe ,  
 (10) (13) (45) ,  
 (10) (411), (414) (37) ,  
 45) (13) (37)

(411) (13) (414)  
 , (411) , Ta 1nm  
 , Ru, Cu (411)  
 (10) , (414)  
 , (414)  
 (414) 40kOe , 160kOe  
 (10) (13) (45) ,  
 (10) , (414)  
 (13) 가 ,  
 (13) (13) (414) 가 가 ,

(13) (414) 가 (414)  
 (13) 가 (13) .  
 2 (13) (45) ,  
 (414) , 가 ,  
 , (15) ,  
 .  
 3 , (50) (35), (7  
 3 1) , (10) (72),  
 (36) (43) (40)  
 (10) 가 ( (4  
 40) , 가  
 , (10) 1, 2 가 3  
 .

(14), (11), (15), (12), (13)  
 . (15) 1 (151) 2 (152), (154)  
 . 가 , 가 . (151) 2 (152)  
 (154) 1 (151) 2 (151) 2 (152)  
 , 2 4  
 (15) , (13) 1  
 . , 2  
 2 (13) (12) 가 Co  
 , NiFe ,  
 (10) (13) (45) ,  
 (10) (45)  
 (13) (411), (416), (415), (414) (37)  
 . , (37) .

(411) (13) (416)  
 . (411) Ta 1nm  
 , Ru, Cu (411)  
 (10) (416) (415)  
 (414) , (415)  
 . (415) Ta, (416) (414)  
 , (13) .

(414) ,  
 (414) (416) (414)  
 40kOe , 160kOe .

(10) (13) (45) , (10)  
 (416) , (414)  
 (13) 가 , 가  
 (13) (13) , (416)  
 (414) 가 가 , (13) , (416) (414)  
 가 (416) (414)  
 (13) 가 (13)  
 .

3 (13) (45) ,  
 (416) (414) , 가  
 , (15) ,

4 , 4  
 (50) (35), (71)  
 (10) , (72), (40)  
 (43) , 가 (4)  
 36) (10) 0) , (10) 1 3 가 4  
 .

(14), (11), (15), (12), (13)  
 (15) 1 (151) 2 (152), (154)  
 (154) 1 (151) 2 (152)  
 가 , 가 1 (151) 2 (152)  
 (15) , 2 4  
 , (13) 1  
 2 (13) , 2  
 , (12) 가 Co  
 , NiFe ,  
 (10) (13) (45) ,  
 (10) (45)  
 (13) (411), (416), (415), (414)  
 (37) , (37) .

(411) (13) (416)  
 (411) , Ta 1nm  
 , Ru, Cu (411)  
 (10) 3 (415)  
 (416) (416) (415) (414)  
 , (415) (415) R  
 u, Ir (416) (414)

$$, \quad (13)$$

(414) , (416) (414)  
(416) 40kOe , 160kOe (414)  
(10) (13) (45) ,  
(10) , (414)  
(416) (13) 가 ,  
(416) 가 (13) (13)  
(414) (416) 가 (13) ,  
(414) (13) 가 (414)  
(416) (13) .

4 (13) (416) (414)  
, 가 ,  
(15),  
.  
, 5 8 .

[illegible]
$$\begin{aligned} \text{가} & \quad , \quad 7 \\ & \quad , \quad 7 \end{aligned} \quad (13)$$

, (13) (46) (13) 가 , (13)  
 (13) (46) 가 , 가  
 . (13) (46) ,  
 . (46) 8 (13)  
 . 가 400kA/m ,  
 가 ,  
 , 80kA/m ,  
 , 가  
 , 「 」 .  
 ,  
 9 9 , 9 ,  
 (13) , (45) 가  
 (13) (13) (13) 가  
 (45) , (13) (45) (45)  
 , 10  
 (13) ,  
 1 ,  
 , 1 LLG  
 , 가 5  
 11 1  
 , 가 0.18 $\mu$ m  
 , 3 ,  
 가 , 0.2 $\mu$ m  
 , 0.1 $\mu$ m , 0.05 $\mu$ m

12 13  
 12  
 0.18 $\mu\text{m}$ , 0.16 $\mu\text{m}$  0.1 $\mu\text{m}$   
 . 3 , , 가  
 ,  
 ( 12 ) , 가  
 , 가 12 , 가 ,  
 , 가 ,  
 가 .

12 13  
 12 가 0.18 $\mu\text{m}$ , 0.16  
 $\mu\text{m}$  0.2 $\mu\text{m}$   
 ( 13 ) , 가 ,  
 가 ,  
 , 가 ,

14 1  
 , 가  
 14 가 MnPt MnIr  
 . MnIr 250 , MnPt , MnPt  
 330 , MnPt  
 270 , 230 , MnPt  
 , MnIr  
 ,  
 .

15 10nm 5000 , 40kA  
 /m .  
 (414), 3, 4 1 (412) , 2, 3, 4  
 , 가 . Fe  
 ,  
 ,  
 , 가 .

16 20

16 1  
 nPt 1nm, 2 (152) (50) (14) Ta 3nm, NiFe 3nm, (11) M  
 oFe 2.5nm, (12) CoFe 1.5nm, (154) Ru 0.8nm, 1 (151) C  
 (131) NiFe 4nm, (411) (132) CoFe 0.5nm, 1  
 e 3nm, (413) MnIr 7nm, (37) Cu 1nm, Ta/Ta - O 1.0nm, (412) CoF  
 Ta 3nm

(10) (15) (154), 1  
 (151) 2 (152) (154) Ru 1 (151) 2 (1  
 52) 가 , 1  
 (151) 2 (152) 가 , (13) 1  
 NiFe 2 CoFe 가 ,  
 (45) (13) (411), (412), (413) (37)  
 (411) (10) ,  
 (411) (13)  
 (45), (412) ,  
 (13) (45), (412)  
 (411) 2nm

17 2  
 1 (50) (14) Ta 3nm, NiFe 3nm, (11) M  
 nPt 12nm, 2 (152) CoFe 1.5nm, (154) Ru 0.8nm, 1 (151)  
 CoFe 2.5nm, (12) Cu 2.1nm, 2 (132) CoFe 0.5nm, 1  
 (131) NiFe 4nm, (411) Cu 1nm, Ta/Ta - O 1.0nm, (412) Co  
 Fe/Al<sub>2</sub>O<sub>3</sub> 6nm CoFe 1nm, (413) MnIr 7nm, (37) Ta 3nm

(10) (15) (154), 1  
 (151) 2 (152) (154) Ru 1 (151) 2 (1  
 52) 가 , 1  
 (151) 2 (152) 가 , (13) 1  
 NiFe 2 CoFe 가 ,  
 (45) (13) (411), (412), (413) (37)  
 (411) (10) ,  
 (411) (13)  
 (45), (412) ,  
 (13) (45), (412)  
 (411) 2nm  
 (412) 가 CoFe/Al<sub>2</sub>O<sub>3</sub> , 가



18  
 2  
 Pt 12nm, 2 (152) CoFe 1.5nm, (14) Ta 3nm, NiFe 3nm, (11) Mn  
 oFe 2.5nm, (12) Cu 2.1nm, 2 (154) Ru 0.8nm, 1 (151) C  
 (131) NiFe 4nm, (411) Cu 1nm, Ta/Ta - O 1.0nm Al<sub>2</sub>O<sub>3</sub> 1nm, (41  
 4) Fe<sub>3</sub>O<sub>4</sub> 8nm, (37) Ta 3nm  
  
 (151) 2 (152) (10) (15) (154), 1  
 52) 가 , Ru 1 (151) 2 (1  
 (151) 2 (152) 가 , (13) 1  
 NiFe 2 CoFe 가 ,  
 (45) (13) (411), (414) (37)  
 (411) (10) , (411)  
 (414) (13) (45), (414)  
 (411) 3nm (414) Fe  
 3O<sub>4</sub>  
 19  
 3  
 (11) MnPt 12nm, 2 (152) CoFe 1.5nm, (14) Ta 3nm, NiFe 3nm, 4  
 (151) CoFe 2.5nm, (12) Cu 2.1nm, 2 (154) Ru 0.8nm, 1  
 1 (131) NiFe 4nm, (411) Cu 1nm, Ta/Ta - O 1.0nm Al<sub>2</sub>O<sub>3</sub> 1nm, 5  
 3 1nm, (416) CoFe 1nm, (415) Al<sub>2</sub>O<sub>3</sub> 1nm, (414) Fe<sub>3</sub>O<sub>4</sub> 8nm  
  
 (151) 2 (152) (10) (15) (154), 1  
 52) 가 , Ru 1 (151) 2 (1  
 (151) 2 (152) 가 , (13) 1  
 NiFe 2 CoFe 가 ,  
 (45) (13) (411), (416), (415), (414)  
 (411) (10) , (411) (13)  
 (45), (416) ,  
 (13) (45), (416)  
 (411) 3nm ,  
 (414) Fe<sub>3</sub>O<sub>4</sub>  
  
 (415) (414) (416) Al<sub>2</sub>O<sub>3</sub>  
 (414) (416) (415) R  
 u 4  
  
 20  
 1  
 3nm, (413) NiMn 20nm, (412) CoFe 3nm, (14) Ta 3nm, NiFe  
 Cu 1nm, 1 (131) NiFe 4nm, 2 (132) CoFe 0.5nm, Ru 0.4nm

(12) Cu 2.1nm, 1 (151) CoFe 2.5nm, (154) Ru 0.8nm, 2 (152) CoFe 1.5nm, (11) MnPt 12nm, (37) Ta 3nm

(151) 2 (152) (10) (15) (154), 1  
 52) 가 , (154) Ru 1 (151) 2 (1  
 (151) 2 (152) 가 , (13) 1  
 NiFe 2 CoFe 가 , (37)  
 (45) (13) (411), (412), (413) (37)  
 (411) (10) (411) (13)  
 (45), (412) (13) (45), (412)  
 (411) 1.4nm

21  
 21 (711) , (50) (35),  
 21), (36) (101) , (7  
 (101) (101) (43) (73)  
 가 , 가  
 (101) 21

(14), (11), (15), (121), (13)  
 4) (15) 1 (151) 2 (152), (15  
 (154) 1 (151) 2 (152)  
 가 , 1 (151) 2 (13)  
 152) 가 , (15) , 2  
 4 (13)  
 1 2 (45) (101)  
 , 2 (13) (45) (101)  
 (101) (13) (411), (412), (413) (37) (413) (412)  
 7) 가  
 2 3

(411) (13) (412)  
 u (411) Ta 1nm , Ru, C  
 , Ru 0.8nm ,

(411) , 가  
 (411) , Cu 2nm ,  
 (411) (101)  
 (413)  
 (412) 가 (412) 가  
 (101) (13) (45)  
 (101)  
 (412) (13) 가 , (13) (412) 가  
 (13) (13) (412) 가  
 (412) 가

21 (13) (45)  
 , 가 ,  
 (15) ,  
 21 (121) , (121)  
 CPP

22 ,  
 22  
 (50) (35), (711) (101)  
 (721), (36) (43)  
 (73) (101)  
 가 (101)  
 (73) ,  
 가 (101) 22

(14), (11), (15), (121), (13)  
 (15) 1 (151) 2 (152), (15  
 4) (154) 1 (151) 2 (152)  
 가 , 1 (151) 2 (152)  
 152) 가 , (15) , 2  
 4 (13)  
 1 (133) 2 (134) (13)  
 , 2 (134)  
 , 22 2 (134) (101) (13)  
 , (63) , (63) 가  
 22 1 (133) 2 (134)  
 2 (134) 가  
 (101) (13), 2  
 (45) , (101)

(412), (413), (45), (13), (411),  
 (412), (413), (413), (412), 2 3  
 가

(411) (13) (412) (411) Ta 1nm, Ru, C  
 u (411) (101)  
 (412) 가 (413) (412) 가  
 (101) (13) (45)  
 (412) (101) (13) 가  
 가 (13) (13) (412) (13)  
 (412) 가 가 가 (13) (13) 가  
 가 (412) 가

22 (13) (45)  
 , 가 ,  
 (15) ,

22 (121) (121)  
 CPP

23 (50)  
 (10), (45), (40), (35), (36),  
 (84), (42), (83) , (63) 23  
 가  
 (84), (42), (83)  
 (63)

24 (91)  
 (95) (93) , (92) (90) (95) (9  
 5) , (90) , 가 (92)  
 (94)  
 (94)  
 ,  
 24 (90), (95) 1  
 (95) (91)  
 (90)

25

가

$0.2\mu\text{m}$

$0.2\mu\text{m}$

1

가

(57)

1.

가

가

가

가

2.

(感磁)

가

가 , 가 ,

3.

1 ,

가 가 ,

4.

1 ,

,

5.

1 ,

가

6.

1 ,

Fe, Co, Ni Mn

7.

1 ,

8.

1 ,

9.

1 ,

Ta, Hf, Nb, Ti, W

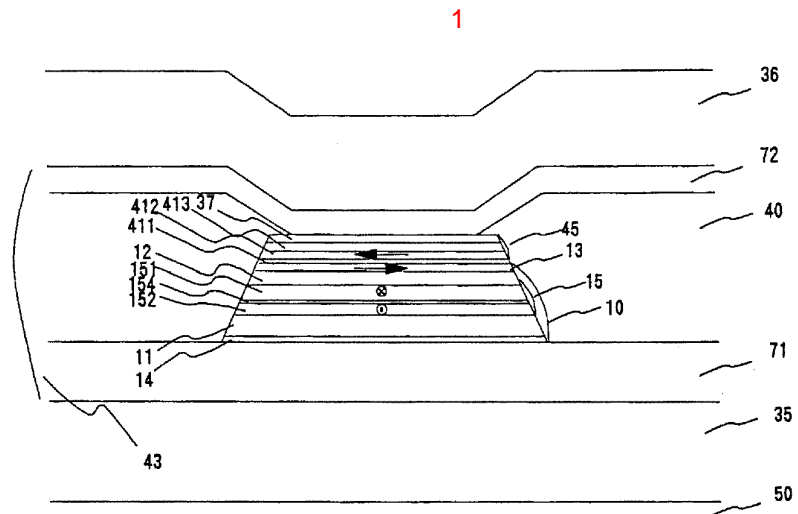
10.

1 ,

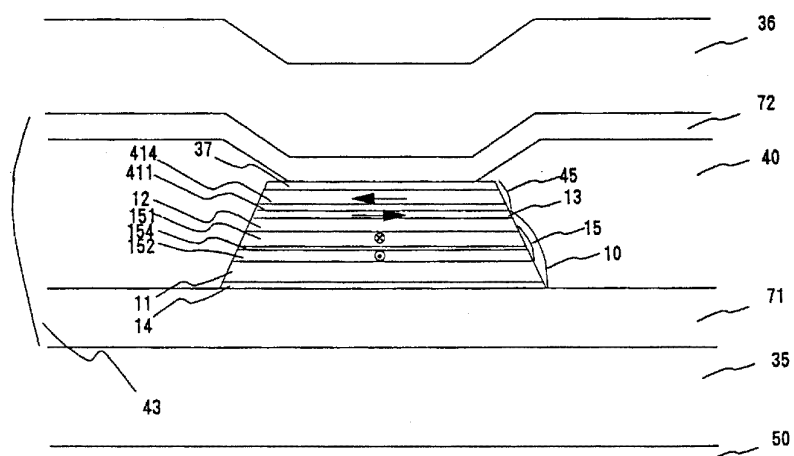
Cu, Au, Ag, Pt, Re, Ru, Ir, Os, Ta, Hf, Nb, Ti, W

, Cu, Au, Ag, Pt, Re, Ru, Ir, Os, Ta, Hf, Nb,

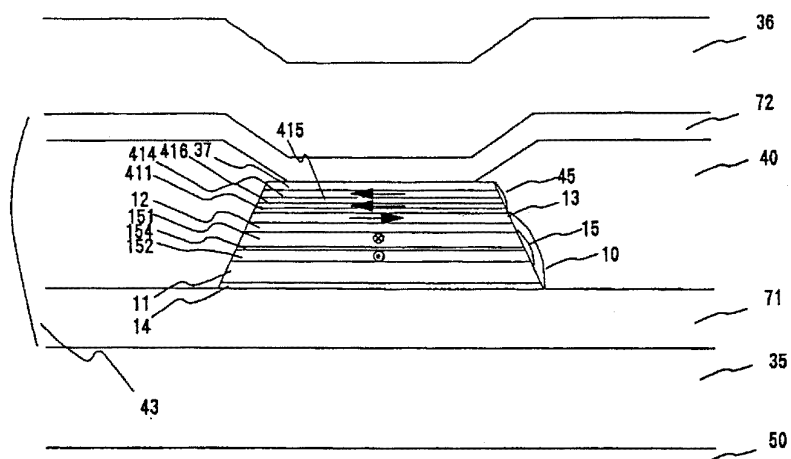
Ti, W



2

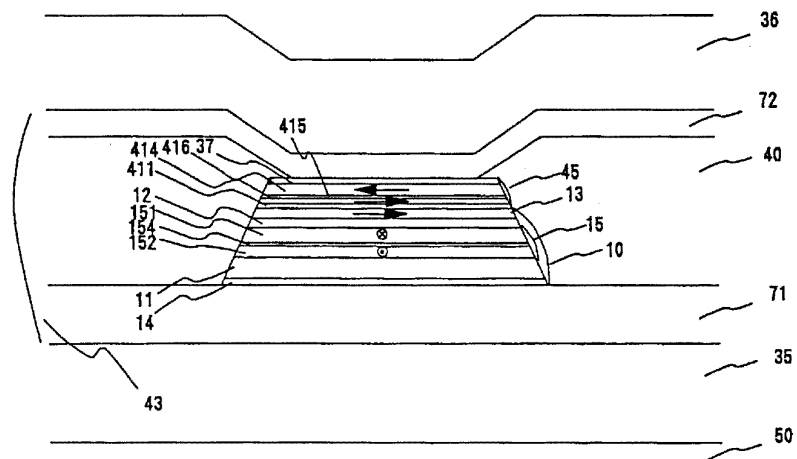


3

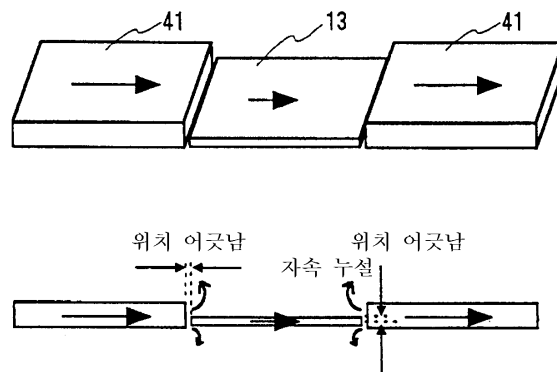




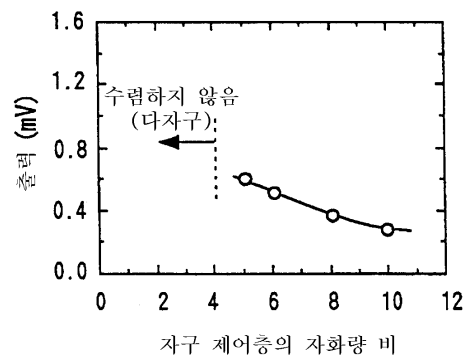
4



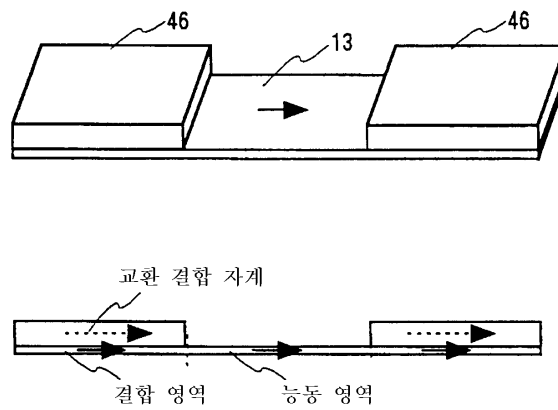
5



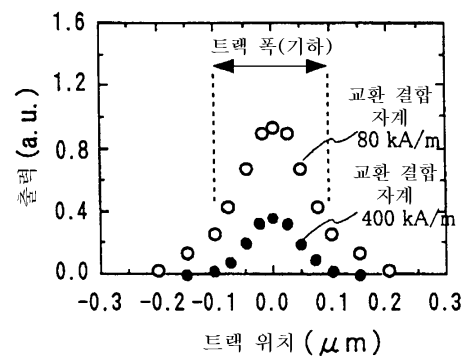
6



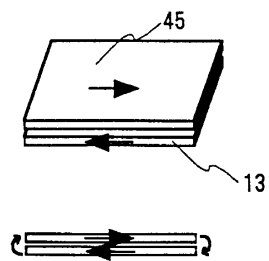
7



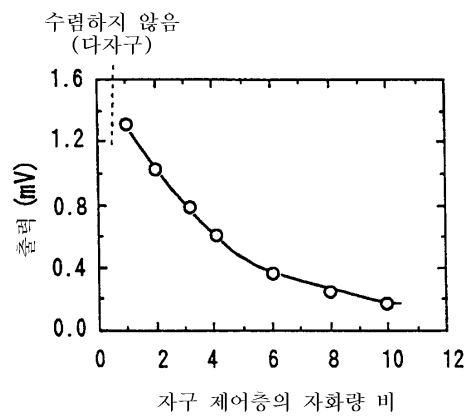
8



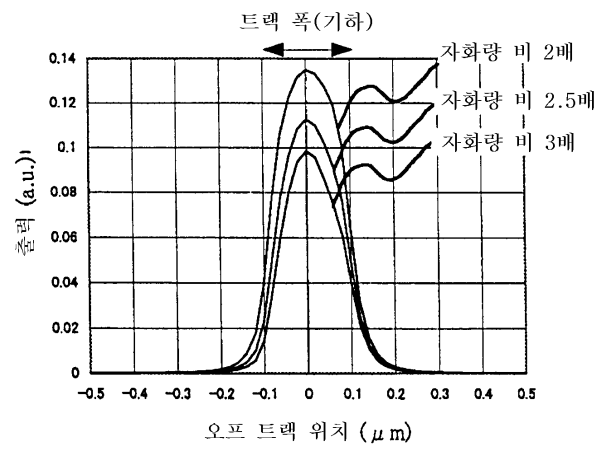
9



10

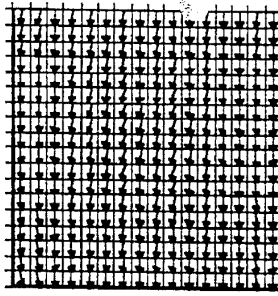


11

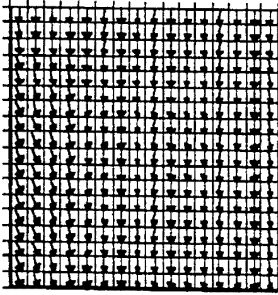


12

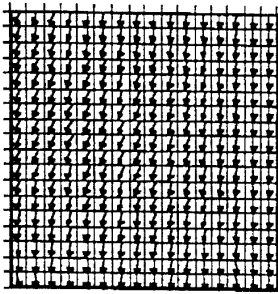
감지해야 할 자계: 체로



감지해야 할 자계: 플리스  
하드 바이어스막의 자화 분포

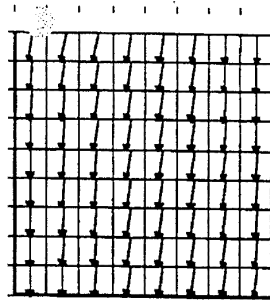


감지해야 할 자계: 마이너스

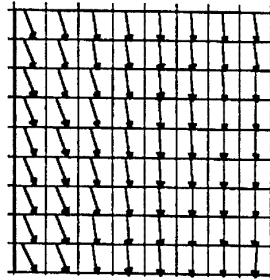


13

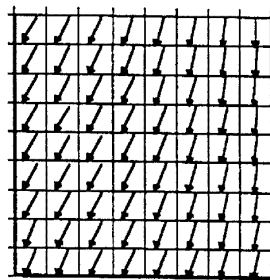
감지해야 할 자계: 계로



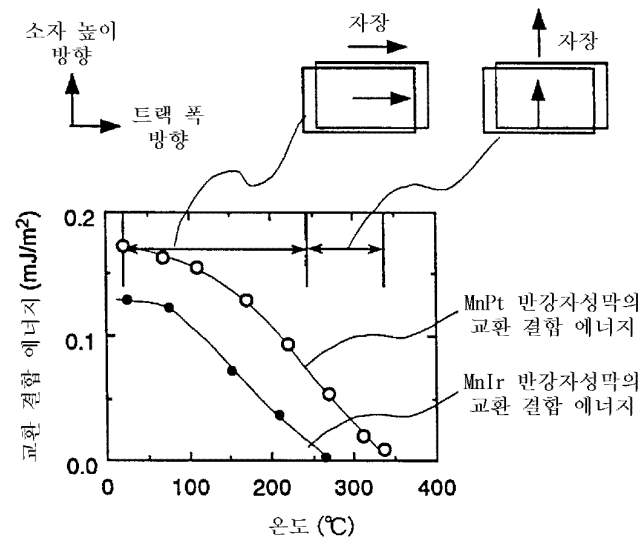
감지해야 할 자계: 플러스



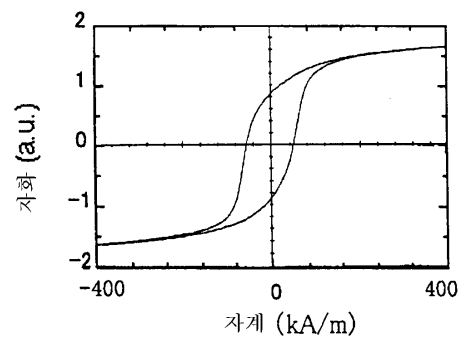
감지해야 할 자계: 마이너스



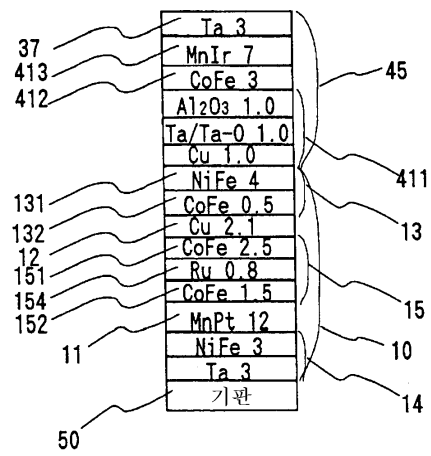
14



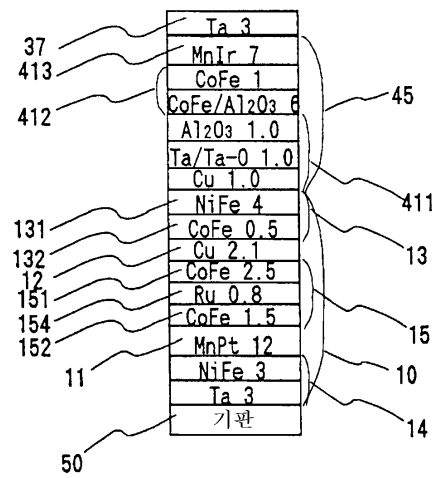
15



16



17





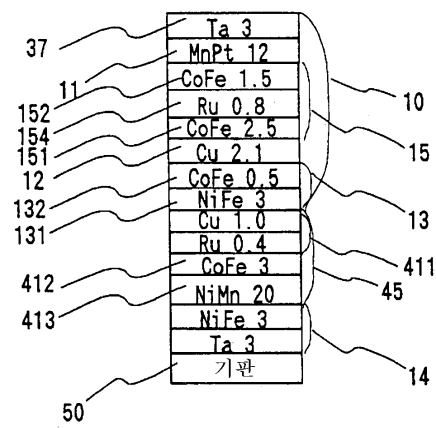
18

37	Ta 3	
	Fe <sub>3</sub> O <sub>4</sub> 8	45
414	Al <sub>2</sub> O <sub>3</sub> 1.0	
415	Ta/Ta-O 1.0	
416	Cu 1.0	411
	NiFe 4	
131	CoFe 0.5	13
132	Cu 2.1	
12	CoFe 2.5	
151	Ru 0.8	15
154	CoFe 1.5	
152	MnPt 12	10
11	NiFe 3	
	Ta 3	14
50	기판	

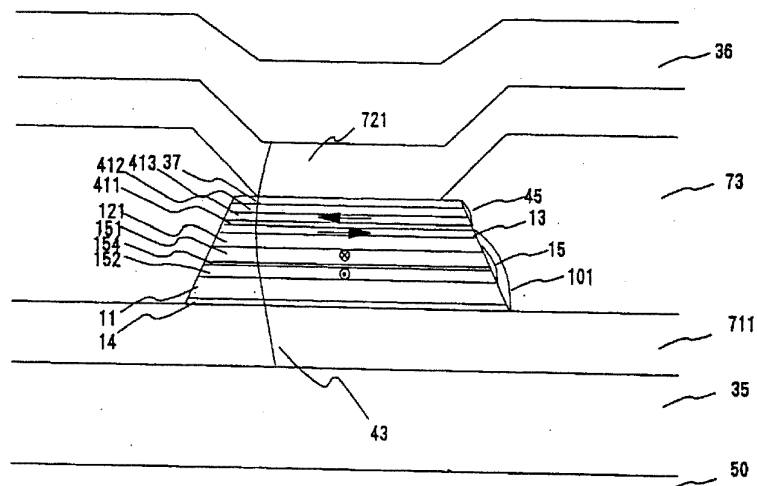
19

	Fe <sub>3</sub> O <sub>4</sub> 8	
414	Al <sub>2</sub> O <sub>3</sub> 1.0	45
415	CoFe 1.0	
416	Ta/Ta-O 1.0	
	Cu 1.0	411
	NiFe 4	
131	CoFe 0.5	13
132	Cu 2.1	
12	CoFe 2.5	
151	Ru 0.8	15
154	CoFe 1.5	
152	MnPt 12	10
11	NiFe 3	
	Ta 3	14
50	기판	

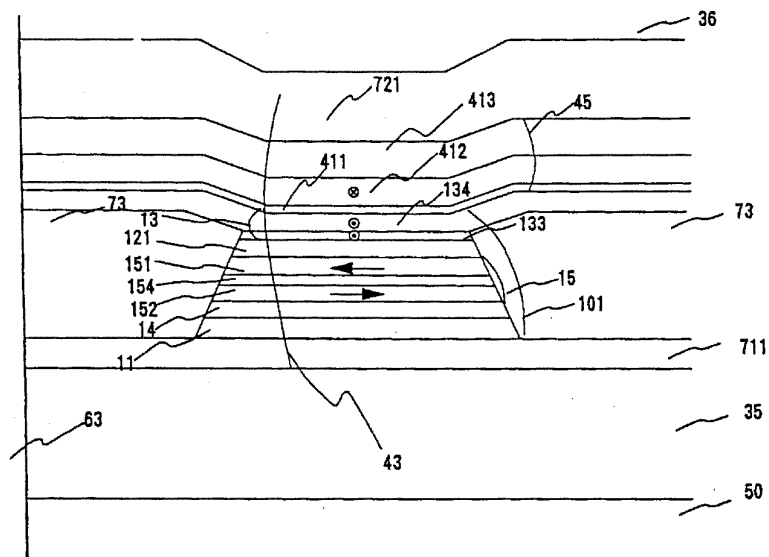
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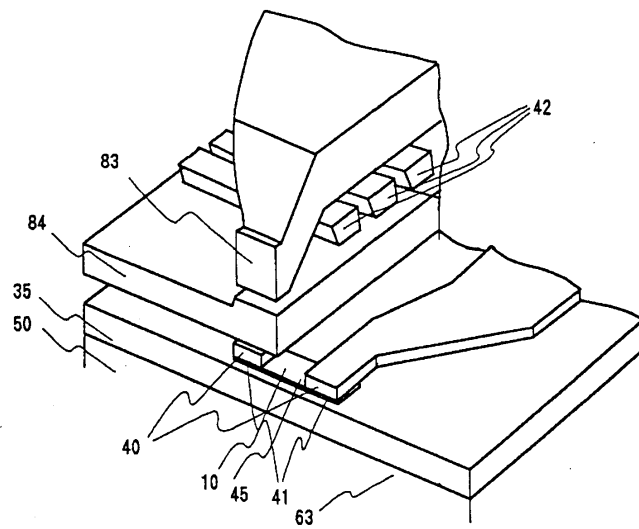
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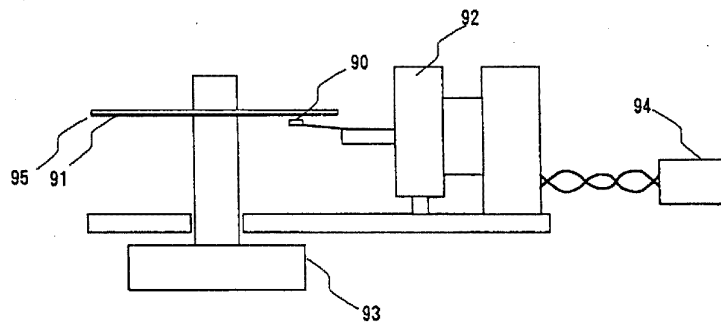
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