

DESCRIPTION

ALLOY FOR A SEED LAYER OF A MAGNETIC RECORDING MEDIUM

5 BACKGROUND OF THE INVENTION

Field of the Invention

[0001]

10 The present invention relates to an alloy for a seed layer of a magnetic recording medium. More specifically, the present invention relates to a Ni-based alloy suitable for forming a seed layer.

Background Art

15 [0002]

 In order to increase the capacity of a recording device, a recording medium adopting the perpendicular magnetic recording system has been developed. In the perpendicular recording system, the easy axis of magnetization in the magnetic film of the recording medium is oriented in the direction perpendicular to the surface of the medium. The perpendicular magnetic recording medium in which this system is adopted has a high recording density.

[0003]

25 The perpendicular magnetic recording medium has a magnetic recording layer and a soft magnetic layer. Between the magnetic recording layer and the soft magnetic layer, an intermediate layer such as a seed layer or an underlying film layer is formed. In the perpendicular magnetic recording medium, a high recording density can be obtained by refinement of crystal grains in the magnetic recording layer. The refinement of the crystal grains and the crystal orientation in the seed layer contribute to the refinement in the magnetic recording layer.

35 [0004]

 A target for an intermediate layer, composed of a Ni-W

alloy, is disclosed in JP2009-155722A. In this target, the variation in the alloy film obtained by sputtering is suppressed because the intensity ratio of X-ray diffraction for the fcc phase of a Ni solid solution is controlled.

5 [0005]

A target for a seed layer, composed of a Ni-Fe-Co-M alloy, is disclosed in JP2012-128933A. This alloy contains W, Mo, Ta, Cr, V or Nb as an element M. This target contributes to the refinement of crystal grains and the orientation to the plane (111) in the seed layer.

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[0006]

A target for a seed layer, composed of a Ni-Fe-Co-M alloy, is disclosed in JP2017-191625A. This alloy contains Au, Ag, Pd, Rh, Ir, Ru, Re or Pt as an element M. This target contributes to the refinement of crystal grains and the orientation to the plane (111) in the seed layer.

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Citation List

Patent Literature

20 [0007]

Patent Literature 1: JP2009-155722A

Patent Literature 2: JP2012-128933A

Patent Literature 3: JP2017-191625A

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SUMMARY OF THE INVENTION

Technical Problem

[0008]

In recent years, further improvement of the recording density of magnetic recording mediums has been demanded. There is still room for the improvement of the orientation to the plane (111) and the refinement of the crystal grains in the seed layer obtained from the targets composed of the alloy disclosed in Patent Literature 1 to 3. Furthermore, the present inventors have found that the corrosion resistance of the seed layer obtained from the target proposed in Patent Literature 3 is low,

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resulting in a problem of corrosion in the environment in which the recording medium is used.

[0009]

5 An object of the present invention is to provide an alloy for a seed layer which can provide a magnetic recording medium having a high recording density and excellent corrosion resistance.

Solution to Problem

10 [0010]

The alloy for a seed layer of a magnetic recording medium according to the present invention includes: Ni; at least one selected from Fe and Co; one or more elements M1 selected from the group consisting of W, Mo, Ta, Cr, V and Nb; one or
15 more elements M2 selected from the group consisting of Au, Ag, Pd, Rh, Ir, Ru, Re and Pt; and unavoidable impurities. The content of the one or more elements M1 in the alloy for a seed layer according to the present invention is 2 at.% or more and 13 at.% or less. The content of the one or more elements M2
20 in the alloy for a seed layer according to the present invention is 2 at.% or more and 13 at.% or less. The sum of the content of the one or more elements M1 and the content of the one or more elements M2 in the alloy for a seed layer according to the present invention is 4 at.% or more and 15 at.% or less. When
25 a ratio of Ni:Fe:Co, which is a ratio of the content of Ni (at.%), the content of Fe (at.%), and the content of Co (at.%) in the alloy for a seed layer according to the present invention, is expressed as Ni:Fe:Co=X:Y:Z, X is 20 or more and 100 or less, Y is 0 or more and 50 or less, and Z is 0 or more and 60 or less.

30 [0011]

Preferably, the alloy for a seed layer according to the present invention further comprises one or more elements M3 selected from the group consisting of Al, Ga, In, Si, Ge, Sn, Zr, Ti, Hf, B, Cu, P, C, and Mn. The content of the one or more
35 elements M3 in the alloy for a seed layer according to the present invention is more than 0 at.% and 5 at.% or less.

[0012]

According to another aspect, the sputtering target according to the present invention is composed of the alloy for a seed layer according to the present invention. The sputtering target according to the present invention can be obtained, using as a material the alloy for a seed layer according to the present invention.

[0013]

According to yet another aspect, the magnetic recording medium according to the present invention includes a seed layer composed of the alloy for a seed layer according to the present invention. This seed layer can be obtained by sputtering. For this sputtering, a target composed of the alloy for a seed layer according to the present invention can be used.

Advantageous Effects of the Invention

[0014]

The alloy for a seed layer according to the present invention can provide a seed layer having high level of orientation to the plane (111), a refined size of crystal grains, and excellent corrosion resistance. The alloy for a seed layer according to the present invention can contribute to the improvement of the recording density and the suppression of corrosion of the magnetic recording medium.

DETAILED DESCRIPTION OF THE INVENTION

[0015]

The present invention will be described below in detail by way of preferred embodiments. In the present application, "X to Y" indicating the range means "X or more and Y or less". Unless otherwise noted, "ppm" means "mass ppm".

[0016]

The alloy for a seed layer of a magnetic recording medium according to the present invention includes: Ni; at least one selected from Fe and Co; one or more elements M1 selected

from the group consisting of W, Mo, Ta, Cr, V and Nb; one or more elements M2 selected from the group consisting of Au, Ag, Pd, Rh, Ir, Ru, Re and Pt; and unavoidable impurities.

[0017]

5 A Ni-Fe-Co-based alloy consisting of Ni, at least one selected from Fe and Co, and unavoidable impurities has an fcc structure. Although the mechanism is not clear, both of the one or more elements M1 and the one or more elements M2 have a function to change the preferential orientation of the fcc
10 structure of the Ni-Fe-Co-based alloy from (200) to (111) and to refine the crystal grains. One feature of the alloy for a seed layer according to the present invention is addition of both the one or more elements M1 and the one or more elements M2 to the Ni-Fe-Co-based alloy. In the seed layer obtained from this
15 alloy, by the synergistic effect of the one or more elements M1 and the one or more elements M2, the orientation to the plane (111) is remarkably improved, and the crystal grains are refined. Moreover, as a result of diligent studies, the present inventors have found that the problem of low corrosion resistance of the
20 seed layer, which has not been noticed so far, can be solved by the use of the one or more elements M1 and the one or more elements M2 in combination. In the perpendicular magnetic recording medium including this seed layer, a high recording density can be achieved, and the corrosion in the usage
25 environment can be avoided.

[0018]

From the point of view of the improvement of orientation to the plane (111) and the refinement of crystal grains, the content of the one or more elements M1 is 2 at.% or more. An
30 excessive amount of the one or more elements M1 shifts the structure of the seed layer to a structure other than the fcc structure. From the point of view of the maintenance of the fcc structure of the seed layer, the content of the one or more elements M1 is 13 at.% or less, and preferably 10 at.% or less.

35 [0019]

As described above, the one or more elements M1 are

selected from the group consisting of W, Mo, Ta, Cr, V and Nb. When two or more elements are selected as the one or more elements M1, the total content of the selected two or more elements is adjusted as described above.

5 [0020]

From the point of view of the improvement of orientation to the plane (111) and the refinement of crystal grains, the content of the one or more elements M2 is 2 at.% or more. From the point of view of the maintenance of the fcc structure
10 of the seed layer and the improvement of the corrosion resistance, the content of the one or more elements M2 is 13 at.% or less, and preferably 10 at.% or less.

[0021]

As described above, the one or more elements M2 are
15 selected from the group consisting of Au, Ag, Pd, Rh, Ir, Ru, Re and Pt. When two or more elements are selected as the one or more elements M2, the total content of the selected two or more elements is adjusted as described above.

[0022]

20 From the point of view of the increase in recording density and the improvement of corrosion resistance of the perpendicular magnetic recording medium, the sum of the content of the one or more elements M1 and the content of the one or more elements M2 is 4 at.% or more, and preferably 5
25 at.% or more. From the point of view of the maintenance of the fcc structure of the seed layer, the sum of the content of the one or more elements M1 and the content of the one or more elements M2 is 15 at.% or less, and preferably 13 at.% or less.

[0023]

30 In the alloy for a seed layer according to the present invention, the ratio of Ni:Fe:Co, which is the ratio of the content of Ni (at.%), the content of Fe (at.%), and the content of Co (at.%), is expressed as Ni:Fe:Co=X:Y:Z. Note that X+Y+Z=100.

35 [0024]

In the alloy for a seed layer according to the present

invention, X is 20 or more and 100 or less. An alloy having an X of 20 or more provides a seed layer in which the coercive force is suppressed. From this point of view, X is preferably 40 or more, more preferably 60 or more.

5 [0025]

In the alloy for a seed layer according to the present invention, Y is 0 or more and 50 or less. An alloy having Y within this range provides a seed layer in which the coercive force is suppressed. From this point of view, Y is preferably 2
10 or more, more preferably 10 or more and 40 or less.

[0026]

In the alloy for a seed layer according to the present invention, Z is 0 or more and 60 or less. An alloy having Z within this range provides a seed layer in which the coercive
15 force, especially in the direction of (111), is suppressed. From this point of view, Z is preferably 40 or less, more preferably 30 or less.

[0027]

The alloy for a seed layer according to the present
20 invention can include one or more elements M3 selected from the group consisting of Al, Ga, In, Si, Ge, Sn, Zr, Ti, Hf, B, Cu, P, C, and Mn. The one or more elements M3 can promote the refinement of crystal grains in the obtained seed layer. The seed layer obtained using the alloy containing the one or more
25 elements M3 can achieve a further higher recording density of the perpendicular magnetic recording medium.

[0028]

From the point of view of the refinement of crystal grains and the maintenance of the fcc structure of the seed layer, the
30 content of the one or more elements M3 is preferably more than 0 at.% and 5 at.% or less. The content of the one or more elements M3 is more preferably 3 at.% or less. When two or more elements are selected as the one or more elements M3, the total content of the selected two or more elements is
35 adjusted as described above.

[0029]

The sputtering target according to the present invention is composed of the alloy for a seed layer according to the present invention. In other words, the material of the sputtering target according to the present invention is an alloy that includes: Ni; at least one selected from Fe and Co; one or more elements M1 selected from the group consisting of W, Mo, Ta, Cr, V and Nb; one or more elements M2 selected from the group consisting of Au, Ag, Pd, Rh, Ir, Ru, Re and Pt; and unavoidable impurities. The content of the one or more elements M1 in the sputtering target according to the present invention is 2 at.% or more and 13 at.% or less. The content of the one or more elements M2 in the sputtering target according to the present invention is 2 at.% or more and 13 at.% or less. The sum of the content of the one or more elements M1 and the content of the one or more elements M2 in the sputtering target according to the present invention is 4 at.% or more and 15 at.% or less. When the ratio of Ni:Fe:Co, which is the ratio of the content of Ni (at.%), the content of Fe (at.%), and the content of Co (at.%) in the sputtering target according to the present invention, is expressed as Ni:Fe:Co=X:Y:Z, X is 20 or more and 100 or less, Y is 0 or more and 50 or less, and Z is 0 or more and 60 or less. The sputtering target according to the present invention can be produced as follows: a raw material powder composed of the alloy for a seed layer according to the present invention is heated under high pressure and solidified to form a sintered body; and the sintered body is processed by mechanical means and the like into an appropriate shape.

[0030]

As long as the effects of the present invention can be obtained, the method and conditions for solidifying the raw material powder composed of the alloy for a seed layer are not particularly limited, and the hot hydrostatic pressing method (HIP method), the hot press method, the spark plasma sintering method (SPS method), the hot extrusion method, or the like is appropriately selected.

[0031]

For example, according to the hot hydrostatic pressing method (HIP method), a raw material powder composed of the alloy for a seed layer is first filled in a carbon steel can. This
5 can is vacuum-degassed and sealed to form billets. A sintered body is formed by HIP molding (hot isostatic pressing) on the billets. The pressure for HIP molding is preferably 50 MPa or more and 300 MPa or less, and the sintering temperature is preferably 800°C or more and 1350°C or less. A sputtering
10 target is obtained by wire-cutting, lathe-processing, and surface-polishing the obtained sintered body to form a predetermined shape.

[0032]

The raw material powder used in the production of the
15 sputtering target is produced by a known atomization method. The type of the atomization method is not particularly limited, and a gas atomization method, a liquid atomization method, or a centrifugal atomization method may be used. The gas atomization method is preferably used. When the atomization
20 method is carried out, known atomization devices and manufacturing conditions are appropriately selected and used.

[0033]

The powder obtained by the atomization method is classified as necessary. By classification, for example, particles
25 having a particle size of 500 μm or more (coarse powder) that hinder sintering can be removed. The powder after this classification may be used as a raw material powder for target production.

[0034]

30 The seed layer according to the present invention is composed of the alloy for a seed layer according to the present invention. By sputtering with a target composed of the alloy for a seed layer according to the present invention, a seed layer having the same composition as the alloy for a seed layer
35 according to the present invention can be formed. In other words, the seed layer according to the present invention can be

obtained by sputtering with the target composed of the alloy that includes: Ni; at least one selected from Fe and Co; one or more elements M1 selected from the group consisting of W, Mo, Ta, Cr, V and Nb; one or more elements M2 selected from the group consisting of Au, Ag, Pd, Rh, Ir, Ru, Re and Pt; and unavoidable impurities. The content of the one or more elements M1 in the alloy used as the target is 2 at.% or more and 13 at.% or less. The content of the one or more elements M2 in the alloy used as the target is 2 at.% or more and 13 at.% or less. The sum of the content of the one or more elements M1 and the content of the one or more elements M2 in the alloy used as the target is 4 at.% or more and 15 at.% or less. When the ratio of Ni:Fe:Co, which is the ratio of the content of Ni (at.%), the content of Fe (at.%), and the content of Co (at.%) in the alloy used as the target, is expressed as Ni:Fe:Co=X:Y:Z, X is 20 or more and 100 or less, Y is 0 or more and 50 or less, and Z is 0 or more and 60 or less. The magnetic recording medium according to the present invention includes the seed layer according to the present invention. By using the seed layer according to the present invention as a seed layer in a magnetic recording medium, the magnetic recording medium according to the present invention can be obtained. The magnetic recording medium according to the present invention is preferably a perpendicular magnetic recording medium. The magnetic recording medium according to the present invention has a high recording density. The magnetic recording medium according to the present invention has excellent corrosion resistance.

EXAMPLES

[0035]

The effects of the present invention will now be clarified by way of Examples; however, it is noted that the present invention should not be construed as being limited to the description of these Examples.

[0036]

A seed layer of a magnetic recording medium is formed on a glass substrate by sputtering a target having the same component as the components of the seed layer. This seed
 5 layer is obtained by quenching and solidification. The formation of the seed layer requires a lot of work. Therefore, instead of a seed layer, a quenched thin band prepared by a single-roll quenching device was evaluated in each evaluation test described later. In the single-roll quenching device, the
 10 quenched thin band is created through the steps of quenching and solidification as in the case of sputtering. By using the quenched thin band as a test piece, various characteristics of the seed layer obtained by sputtering can be easily evaluated.

[0037]

15 Into a water-cooled copper mold (diameter of 10 mm and length of 40 mm), 30 g of the raw material weighed so as to have the composition shown in Tables 1 to 3 below was placed. The mold was depressurized and arc-melted in an argon gas atmosphere to obtain a molten base material. This molten
 20 base material was put into a quartz tube having a diameter of 15 mm, discharged from a nozzle, and subjected to a single-roll type quenching device to prepare a quenched thin band. The conditions for producing the quenched thin band are as follows. The obtained quenched thin band was used as a test piece and
 25 subjected to each evaluation test.

Diameter of the discharge nozzle: 1 mm

Atmospheric pressure: 61 kPa

Spray differential pressure: 69 kPa

Roll material: copper

30 Roll diameter: 300 mm

Roll rotation speed: 3000 rpm

Gap between the roll and the discharge nozzle: 0.3 mm

[0038]

Tables 1 to 3 show the component compositions. Taking
 35 No. 1 as an example, "2Ta" and "3Pt" in No. 1 indicate that the content of Ta is 2 at.% and the content of Pt is 3 at.%,

respectively. In addition, the ratio of X:Y:Z (i.e., the content ratio (at.%) of Ni, Fe, and Co) in No. 1 is 100:0:0. The balance of the alloys shown in Tables 1 to 3 is unavoidable impurities.

[0039]

5 [Coercive force]

A test piece was attached with a double-sided tape to the sample table of a vibrating sample coercive force meter, and the coercive force was measured under the condition of an initial applied magnetic field of 144 kA/m. The measurements were
10 rated based on the following criteria. The results are shown in Tables 1 to 3 below. The evaluation is high in the order of III, II, and I.

I: Coercive force is 300 A/m or less.

II: Coercive force is more than 300 A/m and 500 A/m or
15 less.

III: Coercive force is more than 500 A/m.

[0040]

[Saturation magnetic flux]

A test piece (about 15 mg) was collected from the quenched thin band, and the saturation magnetic flux was
20 measured under the condition of an applied magnetic field of 1200 kA/m, using a VSM device (vibrating sample magnetometer). The measurements were rated based on the following criteria. The results are shown in Tables 1 to 3 below.
25 The evaluation is high in the order of III and I.

I: 0.2T or more.

III: Less than 0.2T.

[0041]

[Crystal grain size]

30 A microstructure image of the cross section of the test piece in the roll direction was obtained. The crystal grain size was measured in accordance with the provisions of "Steels - Micrographic determination of the apparent grain size" of "JIS G 0551". The measurements were rated based on the following
35 criteria. The results are shown in Tables 1 to 3 below. The evaluation is high in the order of III, II, and I.

I: P/Lt is 1.5 or more.

II: P/Lt is 1.2 or more and less than 1.5.

III: P/Lt is less than 1.2.

[0042]

5 [Orientation]

A test piece was attached to a glass plate with a double-sided tape in a way that the contact surface with the copper roll was the measurement surface, and a diffraction pattern was obtained by an X-ray diffractometer. The diffraction conditions are as follows.

X-ray source: Cu- α ray

Scanning speed: 4°/min

[0043]

In this diffraction pattern, the intensity ratio of the intensity I (111) of the X-ray diffracted on the plane (111) to the intensity I (200) of the X-ray diffracted on the plane (200), was obtained as I(111)/I(200). The measurements were rated based on the following criteria.

I: Intensity ratio I(111)/I(200) is 0.7 or more.

20 III: Intensity ratio I(111)/I(200) is less than 0.7.

The test pieces which did not maintain the fcc structure and which were amorphized were also evaluated as III. The results are shown in Tables 1 to 3 below. The evaluation is high in the order of III and I.

25 [0044]

[Corrosion resistance]

A test piece (50 mg) was taken from the quenched thin band and its mass was accurately weighed. This test piece was immersed in 10 ml of an aqueous solution of HNO₃ with a concentration of 3 wt.%. After this test piece was allowed to stand at room temperature for 1 hour, the amounts of Ni, Fe and Co eluted in the immersion liquid, HNO₃ aqueous solution, were measured by ICP. The total elution amount of Ni, Fe and Co (Ni + Fe + Co) was determined and rated based on the following criteria. The results are shown in Tables 1 to 3 below. The evaluation is high in the order of III, II, and I.

I: (Ni + Fe + Co) is less than 50 ppm.

II: (Ni + Fe + Co) is 50 ppm or more and less than 150 ppm.

III: (Ni + Fe + Co) is 150 ppm or more.

5 [0045]

[Table 1]

Table 1: Examples

No	Component Composition (at.%)					
	Ni-Fe-Co			Element(s) M1	Element(s) M2	Element(s) M3
	X	Y	Z			
1	100	0	0	2Ta	3Pt	
2	50	20	30	5Mo	3Re	
3	50	50	0	10Nb	3Au	
4	40	0	60	3Cr	10Pd	
5	70	30	0	6W	3Ru	
6	80	0	20	13V	1Rh1Ir	
7	80	0	20	2V	6Re6Ru	
8	50	20	30	2Ta2W	2Ru2Pt	
9	50	50	0	2Cr2V4Nb	2Re2Au	
10	40	0	60	2Cr2Nb2W	2Ru2Re	
11	70	30	0	5V5W	2Pd2Au1Pt	
12	85	0	15	3Ta3W	3Ru	
13	70	30	0	4Mo	4Re4Pt	
14	85	0	15	4Ta	3Rh3Au	
15	70	30	0	4Mo3Nb	2Ru1Ir	
16	85	0	15	2W	2Re	
17	70	30	0	5Nb5Mo	5Ru	
18	50	20	30	4Cr4Ta	3Re2Pt	
19	50	50	0	5V	2Pd2Rh2Ir2Au2Pt	
20	100	0	0	2Nb	3Au	1Al

Table 1: Examples (Continued)

No	Coercive Force	Saturation Magnetic Flux Density	Crystal Grain Size	Orientation	Corrosion Resistance
1	I	I	II	I	I
2	I	I	II	I	I
3	I	I	I	I	I
4	II	I	II	I	I
5	I	I	II	I	I
6	I	I	II	I	II
7	I	I	II	I	I
8	I	I	I	I	I
9	I	I	II	I	I
10	II	I	I	I	I
11	I	I	I	I	I
12	I	I	I	I	I
13	I	I	II	I	I
14	I	I	II	I	I
15	I	I	I	I	I
16	I	I	II	I	I
17	I	I	I	I	I
18	I	I	I	I	I

19	I	I	II	I	I
20	I	I	I	I	I

[0046]

[Table 2]

Table 2: Examples

No	Component Composition (at.%)					
	Ni-Fe-Co			Element(s) M1	Element(s) M2	Element(s) M3
	X	Y	Z			
21	50	20	30	5W	3Ru	1B
22	50	50	0	10Ta	3Pt	1Si
23	40	0	60	3Mo	10Re	1Zr
24	70	30	0	6Cr	3Ir	2C
25	80	0	20	7V	3Rh	1Al1Si
26	50	20	30	5W	3Re	3Al
27	50	50	0	5Mo	3Ru	5Al
28	40	0	60	3Cr	10Pd	2Al2Mn
29	70	30	0	6W	3Ru	1C1Si1Ti
30	80	0	20	5V	2Rh2Ir	1Ge1Sn1Hf
31	70	30	0	2Ta2W	2Ru2Pt	1Al1Si1Ga1In
32	80	0	20	2V2Cr1Nb	2Re2Au	1P1Ti1Cu
33	70	30	0	4V4W	1Pd2Au2Pt	1B1C1Cu
34	70	0	30	5Ta5W	2Ru	1Ti1Sn
35	70	30	0	4Mo	4Re4Pt	1B1P1Hf
36	80	0	20	4Ta	3Au3Rh	1Al1Ga
37	70	30	0	4Nb3Mo	2Ru1Ir	1Si1Zr1Hf
38	70	0	30	7V	2Rh2Ir	1B1Cu
39	70	30	0	2Ta2W	2Ru2Pt	1Cu1Mn1In

5

Table 2: Examples (Continued)

No	Coercive Force	Saturation Magnetic Flux Density	Crystal Grain Size	Orientation	Corrosion Resistance
21	I	I	I	I	I
22	I	I	I	I	I
23	II	I	I	I	I
24	I	I	I	I	I
25	I	I	I	I	I
26	I	I	I	I	I
27	I	I	I	I	I
28	II	I	I	I	I
29	I	I	I	I	I
30	I	I	I	I	II
31	I	I	I	I	I
32	I	I	I	I	I
33	I	I	I	I	I
34	I	I	I	I	I
35	I	I	I	I	I
36	I	I	I	I	I
37	I	I	I	I	I
38	I	I	I	I	I
39	I	I	I	I	I

[0047]

[Table 3]

Table 3: Comparative Examples

No	Component Composition (at.%)					
	Ni-Fe-Co			Element(s) M1	Element(s) M2	Element(s) M3
	X	Y	Z			
40	100	0	0	2W	1Pt	
41	85	0	15	1Ta	2Ru	
42	70	30	0	5Cr5Nb	5Rh5Ir	
43	50	50	0	4V4Mo4Nb4W	4Pd	
44	50	20	30	2Mo3Nb	4Ru4Re4Au4Pt	
45	100	0	0	1W	2Ru	1Al1Si
46	70	30	0	5Cr5W	10Pd	2Ti2Sn
47	40	0	60	4Cr4Mo4Nb4W	4Rh	2B2P2Hf
48	85	0	15	3Ta	1Ir	3Mn2Cu2In
49	50	50	0	5W	3Re3Pd3Rh3Ru	2Al2Mn

Table 3: Comparative Examples (Continued)

No	Coercive Force	Saturation Magnetic Flux Density	Crystal Grain Size	Orientation	Corrosion Resistance
40	I	I	III	I	III
41	I	I	III	I	II
42	I	III	I	III	I
43	I	I	I	III	I
44	II	III	I	III	I
45	I	I	III	I	III
46	I	III	I	III	I
47	I	III	II	III	I
48	I	I	II	III	III
49	I	I	I	III	I

5

[0048]

As shown in Tables 1 to 3, the Examples (Nos. 1 to 39) showed good evaluation results regarding coercive force, saturation magnetic flux density, crystal grain size, orientation and corrosion resistance, because, in the alloys of the Examples, Ni, Fe and Co satisfied the predetermined ratio, the content of the element(s) M1 was adjusted to 2 at.% or more and 13 at.% or less, the content of the element(s) M2 was adjusted to 2 at.% or more and 13 at.% or less, and the sum of the contents of the element(s) M1 and the element(s) M2 was adjusted to 4 at.% or more and 15 at.% or less. Further, the Examples (No. 20 to 39) showed significantly improved crystal grain size by containing the element(s) M3 of 5 at% or less.

[0049]

On the other hand, in the Comparative Examples (No. 40,

41 and 45), the sum of the contents of the elements M1 and M2 was less than 4 at.%, and thus, the crystal grains were not sufficiently refined, with poor corrosion resistance. In the Comparative Example (No. 48), although the sum of the contents of the elements M1 and M2 was 4 at.%, the element(s) M2 was as small as less than 2 at.%, which resulted in poor corrosion resistance and no improvement of the orientation to the plane (111). In the Comparative Examples (No. 42 to 44, 46, 47 and 49), the sum of the contents of the elements M1 and M2 was more than 15 at.%, and thus, the orientation to the plane (111) was lowered, and the fcc structure could not be maintained in some cases. Furthermore, a decrease in the magnetic characteristic (saturation magnetic flux density) was also observed.

[0050]

As described above, the alloy for a seed layer according to the present invention can provide a seed layer having excellent various properties. By applying this seed layer, a magnetic recording medium having a high recording density can be obtained. From these evaluation results, the superiority of the present invention is clear.

INDUSTRIAL APPLICABILITY

[0051]

The alloy for a seed layer and the target composed of this alloy as described above can be applied to various magnetic recording medium.

CLAIMS

1. An alloy for a seed layer of a magnetic recording medium, consisting of:

Ni;

at least one selected from Fe and Co;

one or more elements M1 selected from the group consisting of W, Mo, Ta, Cr, V and Nb;

one or more elements M2 selected from the group consisting of Au, Ag, Pd, Rh, Ir, Ru, Re and Pt;

optionally, one or more elements M3 selected from the group consisting of Al, Ga, In, Si, Ge, Sn, Zr, Ti, Hf, B, Cu, P, C, and Mn; and

unavoidable impurities, wherein:

the content of the one or more elements M1 is 2 at.% or more and 13 at.% or less;

the content of the one or more elements M2 is 2 at.% or more and 13 at.% or less;

the sum of the content of the one or more elements M1 and the content of the one or more elements M2 is 4 at.% or more and 15 at.% or less;

the content of the one or more elements M3 is 0 at.% or more and 5 at.% or less; and

when a ratio of Ni:Fe:Co, which is a ratio of the content of Ni (at.%), the content of Fe (at.%), and the content of Co (at.%) in the alloy, is expressed as Ni:Fe:Co=X:Y:Z, X is 20 or more and 100 or less, Y is 0 or more and 50 or less, and Z is 0 or more and 60 or less.

2. The alloy for a seed layer according to claim 1, wherein:

the content of the one or more elements M3 is more than 0 at.% and 5 at.% or less.

3. A sputtering target composed of the alloy according to claim 1 or 2.

4. A magnetic recording medium comprising a seed layer composed of the alloy according to claim 1 or 2.