056105 (2006) “Particulate Structure of FePt thin films enhanced by Au and Ag alloying”

[Summary of Invention]

[Technical Problem]

[0012] The objects of the invention disclosed in the present specification are to provide a magnetic recording layer that has a high magnetic anisotropy constant Ku and a low Curie temperature Tc and to provide a magnetic recording medium that has this magnetic recording layer.

[Solution to Problem]

[0013] The magnetic recording medium of a first embodiment described in the present specification contains a nonmagnetic substrate and a magnetic recording layer wherein this magnetic recording layer contains an ordered alloy, and the ordered alloy contains at least one element selected from the group consisting of Fe and Ni, and at least one element selected from the group consisting of Pt, Pd, Au, Rh and Ir, and also contains Ru. The ordered alloy here is preferably an $L1_0$-type ordered alloy that contains Fe, Pt, and Ru. In addition, the magnetic recording layer preferably has a granular structure that is provided with magnetic crystal grains containing the ordered alloy and a nonmagnetic grain boundary. The nonmagnetic grain boundary of the granular structure preferably contains at least one material selected from the group consisting of carbon, boron, oxides, carbides, and nitrides.

[0014] According to the magnetic recording medium of a second embodiment described in the present specification, the magnetic recording layer in the magnetic recording medium of the first embodiment contains a plurality of magnetic layers and at least one of the plurality of magnetic layers is a magnetic layer that contains the aforementioned ordered alloy. The magnetic recording layer here preferably contains at least one magnetic layer that does not contain the aforementioned ordered alloy. Or, this magnetic recording layer contains at least one layer that has a granular structure provided with magnetic crystal grains and a nonmagnetic grain boundary and the nonmagnetic grain boundary contains at least one material selected from the group consisting of carbon, boron, oxides, carbides, and nitrides. Here, the magnetic crystal grains in at least one magnetic layer that has the granular structure preferably contain the aforementioned ordered alloy. In particular, the magnetic recording medium of this embodiment preferably includes a magnetic recording layer formed of a first magnetic layer and a second magnetic layer formed on the first magnetic layer. The first magnetic layer preferably has a granular structure that is provided with magnetic crystal grains that do not contain the aforementioned ordered alloy and a carbon-containing nonmagnetic grain boundary, and the second magnetic layer preferably has a granular structure that is provided with magnetic crystal grains formed from the aforementioned ordered alloy, and a carbon- and boron-

The order S can be obtained as a square root of a quotient of the measured value for the ratio of the (001) peak integrated intensity to the (002) peak integrated intensity, by the theoretically calculated ratio of the (001) peak integrated intensity to the (002) peak integrated intensity for the case of complete ordering. A magnetic anisotropy constant Ku practicable for a magnetic recording medium is obtained when the thusly obtained order S is equal to or greater than 0.5.

[0025] Or, the single-layer magnetic recording layer 30 may have a granular structure constituted of magnetic crystal grains constituted of the aforementioned ordered alloy and a nonmagnetic grain boundary that surrounds the magnetic crystal grains. The material constituting the nonmagnetic grain boundary includes carbon, boron, carbides, oxides, and nitrides. Oxides usable for the nonmagnetic grain boundary include SiO_2, TiO_2, and ZnO. Nitrides usable for the nonmagnetic grain boundary include SiN and TiN. Or, the nonmagnetic grain boundary may also be formed using two or more materials, such as a mixture of boron (B) and carbon (C). The individual magnetic crystal grains in the granular structure are magnetically isolated by the nonmagnetic grain boundary. This magnetic isolation is effective for improving the SNR of the magnetic recording medium.

[0026] The magnetic recording layer 30 is preferably formed by a sputtering method accompanied by heating of the substrate. The substrate temperature during formation of the

[CLAIMS]

1. A magnetic recording medium comprising:

a nonmagnetic substrate; and

a magnetic recording layer,

wherein the magnetic recording layer contains an ordered alloy, and the ordered alloy contains at least one element selected from the group consisting of Fe and Ni, and at least one element selected from the group consisting of Pt, Pd, Au, Rh and Ir, and also contains Ru, and

wherein a content of Ru is in a range from 0.5 to 20 atom % with reference to the ordered alloy.

2. The magnetic recording medium according to claim 1,

wherein the magnetic recording layer has a normalized anisotropic magnetic field of at least 0.8.

3. The magnetic recording medium according to claim 1, wherein the ordered alloy is an $L1_0$-type ordered alloy containing Fe, Pt, and Ru.

4. The magnetic recording medium according to claim 1, wherein the magnetic recording layer has a granular structure provided with magnetic crystal grains including the ordered alloy and a nonmagnetic grain boundary and wherein the nonmagnetic grain boundary contains at least one material

selected from the group consisting of carbon, boron, carbides, oxides, and nitrides.

5. The magnetic recording medium according to claim 1, wherein the magnetic recording layer includes a plurality of magnetic layers and at least one of the plurality of magnetic layers is a magnetic layer that contains the ordered alloy.

6. The magnetic recording medium according to claim 5, wherein the magnetic recording layer includes at least one magnetic layer that does not contain the ordered alloy.

7. The magnetic recording medium according to claim 5, wherein the magnetic recording layer includes at least one magnetic layer that has a granular structure provided with magnetic crystal grains and a nonmagnetic grain boundary and wherein the nonmagnetic grain boundary contains at least one material selected from the group consisting of carbon, boron, carbides, oxides, and nitrides.

8. The magnetic recording medium according to claim 7, wherein the magnetic crystal grains in at least one magnetic layer that has the granular structure contain the ordered alloy.

9. The magnetic recording medium according to claim 8, wherein the magnetic recording layer is formed of a first magnetic layer and a second magnetic layer formed on the first magnetic layer; the first magnetic layer has a granular structure that is provided with magnetic crystal grains that do not contain the ordered alloy and a carbon-containing nonmagnetic grain boundary; and the second magnetic layer has a granular structure that is provided with magnetic crystal grains formed from the ordered alloy, and a carbon- and boron-containing nonmagnetic grain boundary.

10. The magnetic recording medium according to claim 8, wherein the magnetic recording layer is formed of a first magnetic layer and a second magnetic layer formed on the first magnetic layer; the first magnetic layer has a granular structure that is provided with magnetic crystal grains that contain the ordered alloy and a carbon-containing nonmagnetic grain boundary; and the second magnetic layer has a granular structure that is provided with magnetic crystal grains formed from the ordered alloy, and a carbon- and boron-containing nonmagnetic grain boundary.

11. The magnetic recording medium according to any one of claims 1 to 10, which is used in a thermally-assisted magnetic recording method.