of the hydrocarbon protective film is reduced, it is possible to ensure the wear resistance and sliding properties of the magnetic recording medium. Therefore, this makes it possible to properly reduce the thickness of the entire protective layer including the hydrocarbon protective film.

[0034]

(Structure 9) A laminate manufacturing method of forming a thin film over a substrate, said laminate manufacturing method characterized by comprising

a thin film forming step of forming said thin film using a plasma-converted substance as a material,

wherein said thin film forming step forms said thin film using material substance concentration means for gathering said plasma-converted substance around said substrate. With this structure, it is possible to obtain the same effect as that of Structure 1.

[0034a]

According to a first aspect of this invention, there is provided a magnetic recording medium manufacturing method of forming a thin film over a substrate,

said magnetic recording medium manufacturing method characterized by comprising

a magnetic layer forming step of forming a magnetic layer over said substrate;

a protective film forming step of forming a hydrocarbon protective film over said magnetic layer; and

a thin film forming step of forming said thin film using a plasma-converted substance as a material,

wherein said thin film forming step forms said thin film using material substance concentration means for gathering said plasma-converted substance around said substrate by generating a magnetic field around said substrate using a magnet having a maximum energy product of 1.0 to 50 MGOe, the magnet being provided at a position facing an outermost surface of said hydrocarbon protective film, the outermost surface being opposite of a side of said hydrocarbon protective film that is closer to said magnetic layer;

and said thin film forming step is a step of introducing nitrogen into a surface of said hydrocarbon protective film by a plasma CVD method using a nitrogen gas and by applying a bias voltage to said substrate, thereby forming a film containing the nitrogen at the outermost surface of said hydrocarbon protective film.

[0034b]

According to a second aspect of this invention, there is provided a laminate manufacturing method of forming a thin film over a substrate, said laminate

manufacturing method characterized by comprising:

a magnetic layer forming step of forming a magnetic layer over said substrate;

a protective film forming step of forming a hydrocarbon protective film over said magnetic layer; and

a thin film forming step of forming said thin film using a plasma-converted substance as a material,

wherein said thin film forming step forms said thin film using material substance concentration means for gathering said plasma-converted substance around said substrate by generating a magnetic field around said substrate using a magnet having a maximum energy product of 1.0 to 50 MGOe, the magnet being provided at a position facing an outermost surface of said hydrocarbon protective film, the outermost surface being opposite of a side of said hydrocarbon protective film that is closer to said magnetic layer;

and said thin film forming step is a step of introducing nitrogen into a surface of said hydrocarbon protective film by a plasma CVD method using a nitrogen gas and by applying a bias voltage to said substrate, thereby forming a film containing the nitrogen at the outermost surface of said hydrocarbon protective film.

Effect of the Invention

[0035]

According to this invention, for example, it is possible to have a thin film suitably function even when the thickness of the thin film is reduced.

Best Mode for Carrying Out the Invention

[0036]

Hereinbelow, embodiments according to this invention will be described with reference to the drawings. Fig. 1 shows one example of the structure of a magnetic recording medium 10 manufactured by a magnetic recording medium manufacturing method according to one embodiment of this invention. The magnetic recording medium 10 is a magnetic disk for an LUL system (ramp load system) HDD. The information recording density of the magnetic recording

CLAIMS

1. A magnetic recording medium manufacturing method of forming a thin film over a substrate, said magnetic recording medium manufacturing method characterized by comprising

a thin film forming step of forming said thin film using a plasma-converted substance as a material,

wherein said thin film forming step forms said thin film using material substance concentration means for gathering said plasma-converted substance around said substrate.

2. A magnetic recording medium manufacturing method according to claim 1, characterized in that said material substance concentration means gathers said plasma-converted substance around said substrate by generating a magnetic field around said substrate.

3. A magnetic recording medium manufacturing method according to claim 1 or 2, characterized in that said material substance concentration means generates the magnetic field around said substrate using a magnet having a maximum energy product of 1.0 to 50MGOe.

4. A magnetic recording medium manufacturing method according to any of claims 1 to 3, characterized by further comprising

a magnetic layer forming step of forming a magnetic layer over said substrate, and

a protective film forming step of forming a hydrocarbon protective film over said magnetic layer,

wherein said thin film forming step is a step of introducing nitrogen into a surface of said hydrocarbon protective film by a plasma CVD method using a nitrogen gas, thereby forming a film containing the nitrogen at an outermost surface of said hydrocarbon protective film.

5. A magnetic recording medium manufacturing method according to claim 4, characterized in that said thin film forming step forms the film containing the nitrogen at the outermost surface of said hydrocarbon protective film by applying a bias voltage to said substrate.

6. A magnetic recording medium manufacturing method according to claim 5, characterized in that said thin film forming step applies an RF bias with a power of 400W or less to said substrate.

7. A magnetic recording medium manufacturing method according to any of claims 4 to 6, characterized in that

said protective film forming step forms said hydrocarbon protective film having a thickness of 5nm or less, and

said thin film forming step forms the film containing the nitrogen wherein an atomic ratio (N/C) of nitrogen to carbon at the outermost surface is 0.05 to 0.15.

8. A magnetic recording medium manufacturing method according to any of claims 1 to 3, characterized by further comprising

a magnetic layer forming step of forming a magnetic layer over said substrate,

wherein said thin film forming step is a step of forming a hydrocarbon protective film over said magnetic layer by a plasma CVD method using a hydrocarbon gas.

9. A laminate manufacturing method of forming a thin film over a substrate, said laminate manufacturing method characterized by comprising

a thin film forming step of forming said thin film using a plasma-converted substance as a material,

wherein said thin film forming step forms said thin film using material substance concentration means for gathering said plasma-converted substance around said substrate.

CLAIMS

1. A magnetic recording medium manufacturing method of forming a thin film over a substrate, said magnetic recording medium manufacturing method characterized by comprising

a magnetic layer forming step of forming a magnetic layer over said substrate;

a protective film forming step of forming a hydrocarbon protective film over said magnetic layer; and

a thin film forming step of forming said thin film using a plasma-converted substance as a material,

wherein said thin film forming step forms said thin film using material substance concentration means for gathering said plasma-converted substance around said substrate by generating a magnetic field around said substrate using a magnet having a maximum energy product of 1.0 to 50 MGOe, the magnet being provided at a position facing an outermost surface of said hydrocarbon protective film, the outermost surface being opposite of a side of said hydrocarbon protective film that is closer to said magnetic layer;

and said thin film forming step is a step of introducing nitrogen into a surface of said hydrocarbon protective film by a plasma CVD method using a nitrogen gas and by applying a bias voltage to said substrate, thereby forming a film containing the nitrogen at the outermost surface of said hydrocarbon protective film.

2. A magnetic recording medium manufacturing method according to claim 1, characterized in that said thin film forming step applies an RF bias with a power of 400 W or less to said substrate.

3. A magnetic recording medium manufacturing method according to claim 1, characterized in that said protective film forming step forms said hydrocarbon protective film having a thickness of 5 nm or less, and said thin film forming step forms the film containing the nitrogen wherein an atomic ratio (N/C) of nitrogen to carbon at the outermost surface is 0.05 to 0.15.

4. A magnetic recording medium manufacturing method according to claim 1, wherein said protective film forming step forms said hydrocarbon protective film over said magnetic layer by a plasma CVD method using a hydrocarbon gas.

5. A laminate manufacturing method of forming a thin film over a substrate, said laminate manufacturing method characterized by comprising:

a magnetic layer forming step of forming a magnetic layer over said substrate;

a protective film forming step of forming a hydrocarbon protective film over said magnetic layer; and

a thin film forming step of forming said thin film using a plasma-converted substance as a material,

wherein said thin film forming step forms said thin film using material substance concentration means for gathering said plasma-converted substance around said substrate by generating a magnetic field around said substrate using a magnet having a maximum energy product of 1.0 to 50 MGOe, the magnet being provided at a position facing an outermost surface of said hydrocarbon protective film, the outermost surface being opposite of a side of said hydrocarbon protective film that is closer to said magnetic layer;

and said thin film forming step is a step of introducing nitrogen into a surface of said hydrocarbon protective film by a plasma CVD method using a nitrogen gas and by applying a bias voltage to said substrate, thereby forming a film containing the nitrogen at the outermost surface of said hydrocarbon protective film.