

Target Formed of Sintered Zinc Sulfide-Silicon Dioxide and
Method of Producing the Same

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a sputtering target formed of sintered zinc sulfide-silicon dioxide for forming zinc sulfide-silicon dioxide film serving as a material such as that used for a protective film of phase-change-type optical recording disks. The invention also relates to a method of producing the sputtering target.

Background Art

Zinc sulfide-silicon dioxide (ZnS-SiO_2) is widely employed as a material for forming protective film of a phase-change-type optical recording disk such as CD-RW or DVD-RAM. Such protective film is generally produced through RF (radio-frequency) sputtering, and, in sputtering, a ceramic plate produced by mixing ZnS powder and SiO_2 powder and sintering the resultant mixture is used as a target material. The above sintering is generally performed through hot-pressing.

In recent years, enhancement of the production efficiency of optical recording disks has become an essential issue in accordance with an increasing demand for CD-RW and DVD-RAM. In order to enhance the efficiency, a target material which can be used without breakage against a high input power and which provides a high deposition rate is

required. If such a target material is employed so as to form a film of a predetermined thickness within a shorter period of time, the efficiency of producing the above disks; i.e., the number of disks that can be produced per unit of time, can be enhanced.

Since the deposition rate through sputtering generally increases in proportion to the input power, elevation of the input power effectively increases the deposition rate. However, such a high input power simultaneously imparts a large amount of heat energy to the target material. Thus, insufficient cooling causes accidents, such as breakage of the target material or melting of a bonding material (typically In-containing solder) which is employed for bonding the target and a backing plate. Thus, simply increasing the input power faces limitations.

In addition, when the input power is elevated, anomalous discharge occurs more readily, to thereby disadvantageously disturb favorable deposition. This anomalous discharge tends to be induced by a phenomenon that residual impurity components (derived from ZnS powder serving as a raw material) contained inside the target material are released in the form of gas when the target material is heated to a high temperature due to high input power. Thus, a reduction in impurity level of the inside of the target material is expected.

SUMMARY OF THE INVENTION

In view of the foregoing, the present inventors have carried out extensive studies so as to solve the aforementioned problems, and have found the following.

1. Studies on the correlation between the crystal structure of ZnS—a component of a sputtering target formed of sintered ZnS-SiO₂—and the deposition rate of sputtering have revealed that ZnS of zinc blende (sphalerite) structure (low-temperature-stable phase) provides a remarkably higher deposition rate than does ZnS of wurtzite structure (high-temperature-stable phase).

2. In order to produce a sputtering target formed of sintered ZnS-SiO₂ and predominantly comprising such ZnS of zinc blende structure (low-temperature-stable phase), hot-press-sintering must be performed at 1020°C or lower in the course of production of the target.

3. The sputtering target produced by hot-press-sintering at such a low temperature generally contains disadvantageous residual impurities, such as H₂S and SO₄, derived from ZnS powder serving as a raw material. When the target is heated in the course of sputtering, these impurities are released in gaseous form to a sputtering chamber, and anomalous discharge occurs in the vicinity of the target.

4. In order to solve this problem, the ZnS powder raw material is finely ground in pure water by use of a bead mill, to thereby wash out the impurities such as sulfate radicals (SO₄); the washed powder is calcined at 400°C in the

atmosphere, to thereby decrease gas components; and, subsequently, the calcined powder is hot-press-sintered, to thereby yield a target formed of sintered ZnS-SiO_2 that causes less anomalous discharge and attains a high deposition rate.

5. In addition, ZnS powder is finely ground, to thereby obtain a sputtering target having higher density and break resistance as compared with conventional sputtering targets.

The present invention has been accomplished on the basis of these findings.

Thus, an object of the present invention is to provide a sputtering target formed of sintered zinc sulfide-silicon dioxide, which target attains a high deposition rate without excessive elevation of the input power; prevents breaking and like accidents; and contains, inside the target, residual impurities in reduced amounts. Another object of the invention is to provide a method of producing the sputtering target.

Accordingly, in a first aspect of the present invention, there is provided a sputtering target formed of sintered zinc sulfide-silicon dioxide, which sputtering target comprises ZnS in an amount of 70-90 mol%, the balance being SiO_2 and unavoidable impurities, wherein ZnS constituting the sputtering target exhibits, in an X-ray diffraction chart showing the crystal structure of ZnS , peak intensities satisfying the following expression:

$$0 \leq I(w100)/(I(zb111) + I(w002)) \leq 0.2,$$

wherein $I(w100)$ represents the intensity of the (100) diffraction peak attributed to wurtzite structure;

$I(w002)$ represents the intensity of the (002) diffraction peak attributed to wurtzite structure;

$I(zb111)$ represents the intensity of the (111) diffraction peak attributed to zinc blende structure; and

$(I(zb111) + I(w002))$ represents the intensity of the diffraction peak observed as overlapped diffraction peaks.

In ZnS, the zinc blende structure (low-temperature-stable phase) provides a remarkably higher deposition rate than does the wurtzite structure (high-temperature-stable phase). Accordingly, by providing a ZnS crystal structure in which zinc blende structure (low-temperature-stable phase) is contained within the predetermined range, a high deposition rate can be attained without excessive elevation of the input power.

Here, the sputtering target may be produced by hot-press-sintering in vacuum a mixture of ZnS powder and SiO_2 powder at 900°C-1020°C.

By hot-pressing the powder in vacuum within the predetermined temperature range, a sputtering target having a ZnS crystal structure in which zinc blende structure (low-temperature-stable phase) is contained within the predetermined compositional range can be obtained. Thus, a high deposition rate can be attained without excessive elevation of the input power.

The ZnS powder or the mixture of ZnS powder and SiO_2

powder, serving as a raw material, may exhibit, within the range of 300°C to 500°C, no peak attributed to released H₂S during analysis of gas released during heating in vacuum.

By use of the ZnS powder exhibiting no peak attributed to released H₂S, the sputtering target obtained from the powder contains no residual impurity components derived from a raw ZnS powder, even when the powder has been hot-press-sintered in vacuum at 900°C-1020°C. Thus, accidents such as anomalous discharge can be prevented.

The ZnS powder serving as a raw material may have a mean particle size of 3 μm or less.

By use of ZnS powder having a small mean particle size, a high-density, break-resistant sputtering target can be obtained.

The sputtering target may be produced by use of a raw material which is prepared by wet-grinding at least ZnS while the powder is dispersed in pure water, and drying the resultant powder at 300°C-400°C in the atmosphere.

By wet-grinding the powder in pure water and drying the resultant powder within the specific temperature range, ZnS can be finely ground, and impurity components can be removed, to thereby provide a high-density sputtering target and prevent accidents such as anomalous discharge.

The sputtering target may have a bending strength of 4 kgf/mm² or more.

By controlling the bending strength to 4 kgf/mm² or more, breakage of the sputtering target can be prevented even when

a high amount of electric power is supplied.

In a second aspect of the present invention, there is provided a method of producing a sputtering target formed of sintered zinc sulfide-silicon dioxide by hot-press-sintering in vacuum a mixture of ZnS powder and SiO₂ powder, which method comprises wet-grinding at least ZnS while it is dispersed in pure water, and drying the resultant matter at 300°C-400°C in the atmosphere, to thereby prepare a mixture of ZnS powder and SiO₂ powder serving as a raw material; and hot-press-sintering the mixture in vacuum at 900°C-1020°C.

By wet-grinding in pure water, ZnS can be finely ground, and impurity components can be removed, to thereby provide a high-density sputtering target and prevent accidents such as anomalous discharge. In addition, by hot-pressing the powder in vacuum within the predetermined temperature range, a sputtering target having a ZnS crystal structure in which zinc blende structure (low-temperature-stable phase) is contained within the predetermined compositional range can be obtained. Thus, a high deposition rate can be attained without excessive elevation of the input power.

Here, ZnS powder may be wet-ground while the powder is dispersed in pure water; the resultant powder may be dried in the atmosphere at 300°C-400°C; and the dried powder may be mixed with SiO₂ powder, to thereby prepare a powder mixture serving as a raw material, or ZnS powder and SiO₂ powder may be wet-ground while the powders are dispersed in pure water, and the resultant matter may be dried in the atmosphere at

300°C-400°C, to thereby prepare a powder serving as a raw material, and the powder mixture or the powder serving as a raw material may be hot-press-sintered in vacuum.

By wet-grinding the powder in pure water and drying the resultant powder within a specific temperature range, ZnS can be finely ground, and impurity components can be removed, to thereby provide a high-density sputtering target and prevent accidents such as anomalous discharge.

ZnS constituting the produced sputtering target may exhibit, in an X-ray diffraction chart showing the crystal structure of ZnS, peak intensities satisfying the aforementioned formula.

In ZnS, the zinc blende structure (low-temperature-stable phase) provides a remarkably higher deposition rate than does the wurtzite structure (high-temperature-stable phase). Accordingly, by providing a ZnS crystal structure in which zinc blende structure (low-temperature-stable phase) is contained within the predetermined compositional range, a high deposition rate can be attained without excessive elevation of the input power.

The ZnS powder or the mixture of ZnS powder and SiO₂ powder, serving as a raw material, may exhibit, within the range of 300°C to 500°C, no peak attributed to released H₂S during analysis of gas released during heating in vacuum.

By use of the ZnS powder exhibiting no peak attributed to released H₂S, the produced sputtering target contains no residual impurity components derived from a raw ZnS powder,

even when the powder is hot-press-sintered in vacuum at 900°C-1020°C. Thus, accidents such as anomalous discharge can be prevented.

The ZnS powder serving as a raw material may have a mean particle size of 3 μm or less.

By use of ZnS powder having a small mean particle size, a high-density, break-resistant sputtering target can be obtained.

The produced sputtering target may have a bending strength of 4 kgf/mm^2 or more.

By controlling the bending strength to 4 kgf/mm^2 or more, breakage of the sputtering target can be prevented even when high amount of electric power is supplied.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The sputtering target of the present invention formed of sintered zinc sulfide-silicon dioxide has a ZnS crystal structure in which zinc blende structure (low-temperature-stable phase) is contained within the predetermined compositional range. The wurtzite crystal structure type (w type) and the zinc blende crystal structure type (zb type) can be identified through X-ray diffraction. Accordingly, the above range is defined by peak intensities observed in an X-ray diffraction chart showing the crystal structure of ZnS, which intensities satisfy the aforementioned formula.

However, precise measurement of the actual ratio of the

amount of ZnS of zinc blende type (zb type) to that of wurtzite type (w type) is difficult. Thus, in the present invention, the ratio is defined by peak intensities (heights) of X-ray diffraction. Since the main peak attributed to ZnS of zb type and the (002) peak attributed to ZnS of w type overlap each other, the ratio of the main peak height attributed to ZnS of w type to the height of the combined intensity of the overlapped peaks is employed. The peak intensity is based simply on the peak height instead of the integrated intensity.

In order to obtain the sputtering target of the present invention formed of sintered zinc sulfide-silicon dioxide, a mixture of ZnS powder and SiO_2 powder is hot-press-sintered in vacuum at 900°C-1020°C.

When the temperature of hot-press-sintering is in excess of 1020°C, ZnS of w type (high-temperature-stable phase) is formed; i.e., the aforementioned crystal structure cannot be obtained, whereas when the temperature is lower than 900°C, the produced sputtering target has a low density and poor strength, making the target unsuitable for use. Thus, the aforementioned temperature range is selected. In addition, hot-press-sintering is performed in a substantially vacuum atmosphere so as to decrease, through evaporation, impurity components contained inside the sputtering target.

The ZnS powder or the mixture of ZnS powder and SiO_2 powder, serving as a raw material, preferably exhibits, within the range of 300°C to 500°C, no peak attributed to

released H_2S during analysis of gas released during heating in vacuum.

Generally, ZnS raw powder contains impurities such as sulfate radicals (SO_4) and free sulfur (S). Preferably, these impurities are removed so as to prepare a raw material.

In order to effectively remove the impurities, for example, ZnS powder is wet-ground after the powder has been dispersed in pure water in advance, and the resultant powder is dried in the atmosphere at $300^{\circ}C$ – $400^{\circ}C$. Through this treatment, H_2S or free sulfur—a possible source for generating H_2S during sputtering—can be removed. In addition, ZnS powder can be ground finely, to thereby enhance the sinterability thereof. Thus, a sputtering target of high density can advantageously be produced.

When the drying temperature after completion of wet-grinding is lower than $300^{\circ}C$, the effect of oxidizing free sulfur for evaporation is poor, whereas when the temperature is in excess of $400^{\circ}C$, ZnS is oxidized (formation of ZnO by oxidizing ZnS is identified through thermal analysis). Both cases are disadvantageous. ZnS may be ground simultaneously with SiO_2 in pure water.

From a view point of finely grinding ZnS, ZnS powder preferably has a mean particle size of $3\ \mu m$ or less. The size range is selected in order to produce a high-density, break-resistant sputtering target.

The finely ground raw material prepared in the aforementioned manner can provide a sputtering target having

a bending strength of 4 kgf/mm² or more. Thus, breakage of the sputtering target can be prevented even when a high amount of electric power is supplied.

EXAMPLES

The present invention will next be described in detail by way of examples, which should not be construed as limiting the invention thereto.

Example 1

A commercial product of ZnS powder (mean particle size: approximately 6.2 μ m) was dispersed in pure water, and the powder was finely ground by means of a bead mill (ZrO₂ beads, ϕ = 1.25 mm). The thus-ground powder was dehydrated and dried in the atmosphere at 400°C, to thereby yield ground ZnS powder (mean particle size: approximately 2.8 μ m). This powder and SiO₂ powder (mean particle size: approximately 18 μ m) were mixed such that the proportion of the two powders is controlled to 80 : 20 (mol%), and the resultant mixture was hot-press-sintered in vacuum at 1000°C under 270 kgf/cm² for two hours, to thereby obtain a sputtering target material formed of ZnS-SiO₂ and having a density of 3.4 g/cm³.

X-ray diffraction analysis of this sputtering target material revealed that the ratio $I(w100)/(I(zb111) + I(w002))$ was 0.12. The bending strength (JIS R1601-1981) of the target material was measured to be 5.2 kgf/mm².

The produced target material was processed into sputtering target samples (diameter: 8 inches, thickness: 6

mm) .

Each sample was subjected to RF (radio-frequency) sputtering so as to measure the deposition rate. When the input power was 4.5 kW, the rate was found to be 110 Å/s. During sputtering, no breakage or cracks were observed in the target sample.

Before grinding and after grinding and drying, the ZnS powder serving as a raw material was analyzed, under the following conditions, in terms of released gas during heating in vacuum. The results indicate that the ground and dried ZnS powder exhibits a constant peak ionic current—attributed to a mass number of 34 (H_2S)—of 1×10^{-12} A within the range of 300°C to 500°C and that the ZnS powder before grinding exhibits a maximum peak ionic current—attributed to a mass number of 34 (H_2S)—of 1×10^{-10} A within the range of 300°C to 500°C.

(Analysis conditions)

Heating: by IR beam

GC-MS analyzer: Prisma (product of Hakuto-Balzers)

Degree of vacuum attained: approximately 1×10^{-5} Torr

Ar introduction: 1 sccm

Degree of vacuum during measurement: 4.3×10^{-4} Torr

Temperature elevation rate: 10°C/min

Example 2

The procedure of Example 1 was repeated, except that hot-press-sintering was performed at 900°C, to thereby obtain a sputtering target material formed of ZnS-SiO₂ and having a

density of 3.2 g/cm³.

X-ray diffraction analysis of this sputtering target material revealed that the ratio $I(w100)/(I(zb111) + I(w002))$ was 0.03. The bending strength (JIS R1601-1981) of the target material was measured to be 4.5 kgf/mm².

A sputtering target sample which had been prepared in a manner similar to that employed in Example 1 was subjected to RF (radio-frequency) sputtering so as to measure the deposition rate. When the input power was 4.5 kW, the rate was found to be 115 Å/s. During sputtering, no breakage or cracks were observed in the target sample.

Comparative Example 1

The procedure of Example 1 was repeated, except that hot-pressing was performed at 1,100°C, to thereby obtain a sputtering target material formed of ZnS-SiO₂ and having a density of 3.6 g/cm³. X-ray diffraction analysis of this sputtering target material revealed that the ratio $I(w100)/(I(zb111) + I(w002))$ was 1.12. The bending strength (JIS R1601-1981) of the target material was measured to be 8.0 kgf/mm².

A sputtering target sample which had been prepared in a manner similar to that employed in Example 1 was subjected to RF (radio-frequency) sputtering so as to measure the deposition rate. When the input power was 4.5 kW, the rate was found to be 100 Å/s. During sputtering, no breakage or cracks were observed in the target sample.

Comparative Example 2

The procedure of Example 1 was repeated, except that hot-press-sintering was performed at 800°C, to thereby obtain a sputtering target material formed of ZnS-SiO₂ and having a density of 2.7 g/cm³.

X-ray diffraction analysis of this sputtering target material revealed that the ratio $I(w100)/(I(zb111) + I(w002))$ was 0.02. The bending strength (JIS R1601-1981) of the target material was measured to be 2.2 kgf/mm².

A sputtering target sample which had been prepared in a manner similar to that employed in Example 1 was subjected to RF(radio-frequency) sputtering so as to measure the deposition rate. When the input power was 4.5 kW, the target sample was broken at an initial stage of sputtering, making the sample unsuitable for measurement.

Comparative Example 3

The procedure of Example 1 was repeated, except that drying, after completion of grinding by use of a bead mill, was performed at 200°C, to thereby obtain a sputtering target material formed of ZnS-SiO₂ and having a density of 3.4 g/cm³. X-ray diffraction analysis of this sputtering target material revealed that the ratio $I(w100)/(I(zb111) + I(w002))$ was 0.13. The bending strength (JIS R1601-1981) of the target material was measured to be 5.0 kgf/mm².

A sputtering target sample which had been prepared in a manner similar to that employed in Example 1 was subjected to RF(radio-frequency) sputtering so as to measure the deposition rate. When the input power was 4.5 kW, the rate

was found to be 110 Å/s. Although no breakage or cracks were observed in the target sample during sputtering, a number of marks indicating anomalous discharge generation were observed in the vicinity of the target sample.

Comparative Example 4

The procedure of Example 1 was repeated, except that, without performing grinding by means of a bead mill and drying, a commercial product of ZnS powder (mean particle size: approximately 6.2 µm) and SiO₂ powder (mean particle size: approximately 18 µm) were mixed such that the proportion of the two powders was controlled to 80 : 20 (mol%), to thereby obtain a sputtering target material formed of ZnS-SiO₂ and having a density of 2.9 g/cm³.

X-ray diffraction analysis of this sputtering target material revealed that the ratio $I(w100)/(I(zb111) + I(w002))$ was 0.11. The bending strength (JIS R1601-1981) of the target material was measured to be 3.2 kgf/mm².

A sputtering target sample which had been prepared in a manner similar to that employed in Example 1 was subjected to RF (radio-frequency) sputtering so as to measure the deposition rate. When the input power was 4.5 kW, the rate was found to be 110 Å/s. During sputtering, cracks were observed in the target sample, and a number of marks indicating anomalous discharge generation were observed in the vicinity of the target sample.

Table 1 collectively shows the results of the above Examples and Comparative Examples.

Table 1

	Finely grinding in pure water	Drying temp.	Hot-press temp.	Density (g/cm ³)	Peak ratio [*]	deposition rate ^{**}	Anomalous discharge	Remarks
Ex. 1	yes	400°C	1000°C	3.4	0.12	110 Å/s	no	
Ex. 2	yes	400°C	900°C	3.2	0.03	115 Å/s	no	
Comp. Ex. 1	yes	400°C	1100°C	3.6	1.12	100 Å/s	no	
Comp. Ex. 2	yes	400°C	800°C	2.7	0.02	—	—	breaking
Comp. Ex. 3	yes	200°C	1000°C	3.4	0.13	110 Å/s	frequently	
Comp. Ex. 4	no	—	1000°C	2.9	0.11	110 Å/s	frequently	cracking

* : $I(w100) / (I(zb111) + I(w002))$

** : Input power: RF 4.5 kW (target size 8 inches ϕ)

As shown in Table 1, for a given input power, the deposition rate of the target samples having a ratio $I(w100)/(I(zb111) + I(w002))$ falling within the specific range was enhanced approximately 10% as compared with the target samples falling outside the specific range. The target samples produced from a raw material which had been subjected to grinding by means of a bead mill and drying at 300°C-400°C exhibited suppressed anomalous discharge, as compared with the target samples produced from a raw material which had been subjected to no such treatment or which had been dried at lower temperature. The target samples produced from a ground raw material had a density higher than that of the target samples produced from a non-ground raw material; had a high bending strength; and exhibited no breakage or cracks.

As described hereinabove, the present invention provides a sputtering target formed of sintered zinc sulfide-silicon dioxide, which target attains a high deposition rate without excessive elevation of the input power; prevents breakage and like accidents; and contains, inside the target, residual impurities in reduced amounts. The invention also provides a method of producing the sputtering target.



What is claimed is:

1. A sputtering target formed of sintered zinc sulfide-silicon dioxide, which sputtering target comprises ZnS in an amount of 70-90 mol%, the balance being SiO₂ and unavoidable impurities, wherein ZnS constituting the sputtering target exhibits, in an X-ray diffraction chart showing the crystal structure of ZnS, peak intensities satisfying the following expression:

$$0 \leq I(w100)/(I(zb111) + I(w002)) \leq 0.2,$$

wherein I(w100) represents the intensity of the (100) diffraction peak attributed to wurtzite structure;

I(w002) represents the intensity of the (002) diffraction peak attributed to wurtzite structure;

I(zb111) represents the intensity of the (111) diffraction peak attributed to zinc blende structure; and

(I(zb111) + I(w002)) represents the intensity of the diffraction peak observed as overlapped diffraction peaks.

2. A sputtering target formed of sintered zinc sulfide-silicon dioxide according to claim 1, which sputtering target is produced by hot-press-sintering in vacuum a mixture of ZnS powder and SiO₂ powder at 900°C-1020°C.

3. A sputtering target formed of sintered zinc sulfide-silicon dioxide according to claim 1 or 2, wherein the ZnS powder or the mixture of ZnS powder and SiO₂ powder, serving as a raw material, exhibits, within the range of 300°C to 500°C, no peak attributed to released H₂S during analysis of gas released during heating in vacuum.

4. A sputtering target formed of sintered zinc sulfide-silicon dioxide according to any one of claims 1 to 3, wherein the ZnS powder serving as a raw material has a mean particle size of 3 μm or less.

5. A sputtering target formed of sintered zinc sulfide-silicon dioxide according to any one of claims 1 to 4, which sputtering target is produced by use of a raw material which is prepared by wet-grinding at least ZnS powder while the powder is dispersed in pure water, and drying the resultant powder at 300°C-400°C in the atmosphere.

6. A sputtering target formed of sintered zinc sulfide-silicon dioxide according to any one of claims 1 to 5, which sputtering target has a bending strength of at least 4 kgf/mm^2 .

7. A method of producing a sputtering target formed of sintered zinc sulfide-silicon dioxide by hot-press-sintering in vacuum a mixture of ZnS powder and SiO_2 powder, which method comprises wet-grinding at least ZnS while it is dispersed in pure water, and drying the resultant matter at 300°C-400°C in the atmosphere, to thereby prepare a mixture of ZnS powder and SiO_2 powder serving as a raw material; and hot-press-sintering the mixture in vacuum at 900°C-1020°C.

8. A method of producing a sputtering target formed of sintered zinc sulfide-silicon dioxide according to claim 7, wherein ZnS powder is wet-ground while the powder is dispersed in pure water; the resultant powder is dried in the atmosphere at 300°C-400°C; and the dried powder is mixed with



* C L M S *

SiO₂ powder, to thereby prepare a powder mixture serving as a raw material, or ZnS powder and SiO₂ powder are wet-ground while the powders are dispersed in pure water, and the resultant matter is dried in the atmosphere at 300°C-400°C, to thereby prepare a powder serving as a raw material, and the powder mixture or the powder serving as a raw material is hot-press-sintered in vacuum.

9. A method of producing a sputtering target formed of sintered zinc sulfide-silicon dioxide according to claim 7 to 8, wherein ZnS constituting the produced sputtering target exhibits, in an X-ray diffraction chart showing the crystal structure of ZnS, peak intensities satisfying the following expression:

$$0 \leq I(w100)/(I(zb111) + I(w002)) \leq 0.2,$$

wherein I(w100) represents the intensity of the (100) diffraction peak attributed to wurtzite structure;

I(w002) represents the intensity of the (002) diffraction peak attributed to wurtzite structure;

I(zb111) represents the intensity of the (111) diffraction peak attributed to zinc blende structure; and

(I(zb111) + I(w002)) represents the intensity of the diffraction peak observed as overlapped diffraction peaks.

In ZnS, the zinc blende structure (low-temperature-stable phase) provides a remarkably higher deposition rate than does the wurtzite structure (high-temperature-stable phase).

10. A method of producing a sputtering target formed of



sintered zinc sulfide-silicon dioxide according to any one of claims 7 to 9, wherein the ZnS powder or the mixture of ZnS powder and SiO₂ powder, serving as a raw material, exhibits, within the range of 300°C to 500°C, no peak attributed to released H₂S during analysis of gas released during heating in vacuum.

11. A method of producing a sputtering target formed of sintered zinc sulfide-silicon dioxide according to any one of claims 7 to 10, wherein the ZnS powder serving as a raw material has a mean particle size of 3 μm or less.

12. A method of producing a sputtering target formed of sintered zinc sulfide-silicon dioxide according to any one of claims 7 to 11, the sputtering target having a bending strength of at least 4 kgf/mm².

