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(54) METAL MASK MATERIAL AND PRODUCTION METHOD THEREFOR

METALLMASKENMATERIAL UND HERSTELLUNGSVERFAHREN DAFÜR

MATÉRIAU POUR MASQUE MÉTALLIQUE, ET PROCÉDÉ DE FABRICATION DE CELUI-CI

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Description

[Technical Field]

[0001] The present invention relates to a metal mask material and a production method therefor.

[Background Art]

[0002] For example, when an organic EL display is manufactured, a metal mask is used for deposition on a substrate and generation of color patterning. For such a metal mask, a method of performing etching processing on an Fe-Ni alloy thin plate is known as one of methods of forming an opening. In order to improve etching characteristics, various methods have been proposed. For example, Patent Literature 1 describes a material for etching processing in which, in order to enable formation of a high-definition etching pattern, a surface roughness measured in a direction perpendicular to a rolling direction is Ra: 0.08 to 0.20 μm, a surface roughness measured in the rolling direction is Ra: 0.01 to 0.10 μm, and the surface roughness measured in a direction perpendicular to the rolling direction has a rough surface roughness Ra exceeding the surface roughness measured in the rolling direction by 0.02 μm. In addition, Patent Literature 2 describes a metal mask material in which etching properties are improved by adjusting X-ray diffraction intensities of crystal orientations (111), (200), (220), and (311) on the rolled surface. Moreover, Patent Literature 3 relates to a method for producing an Fe-Ni-based alloy thin plate used for, for example, a lead frame or a metal mask. According to this invention, since the adhesiveness can be improved in a thin Fe-Ni-based alloy thin plate having a thickness of 0.25 mm or less, poor adhesion between the Fe-Ni-based alloy thin plate and a counterpart material that is in close contact with the thin plate can be prevented. Here, by setting the surface roughness of the obtained Fe-Ni-based alloy thin plate to Ra = 0.15 to 0.5 μm, the contact area with other members is increased, and the surface of the plate is increased. The anchor effect can be enhanced by the unevenness formed on the surface, and the adhesion can be dramatically improved. When the surface roughness Ra is less than 0.15 μm, the contact area is reduced, and the unevenness of the surface is reduced, so that the adhesive force with the above-described bonding material is reduced. Therefore, the surface roughness is set to Ra = 0.15 μm or more. Further, it is desirable that the surface roughness is higher from the viewpoint of adhesion. However, if the surface roughness is too rough, it becomes a factor that impairs the processing accuracy when performing high-definition etching. Therefore, the upper limit is set to 0.5 μm.

[Citation List]

[Patent Literature]

[0003]

[Patent Literature 1] Japanese Unexamined Patent Application Publication No. 2010-214447
[Patent Literature 2] Japanese Unexamined Patent Application Publication No. 2014-101543
[Patent Litertaure 3] JP 2016 135505 A (Hitachi Metals, Ltd.), 28 July, 2016

[Summary of Invention]

[Technical Problem]

[0004] Patent Literature 1 discloses an invention in which etching characteristics are improved by adjusting a surface roughness Ra measured in a direction perpendicular to a rolling direction and a surface roughness Ra measured in the rolling direction. Patent Literature 2 discloses an invention in which etching properties are improved by adjusting crystal orientations of the rolled surface. However, in order to produce a higher-definition organic EL display, it is necessary to form patterns with higher precision on a mask to be used, and accordingly, further improvement in the etching properties is also required for the metal mask material. On the other hand, it is desirable to adjust the residual stress in the material so that no deformation such as warping occurs even in half etching in various depths. An objective of the present invention is to provide a metal mask material in which change in shape after etching is minimized and which has more favorable etching properties, and a production method therefor.

[Solution to Problem]

[0005] In order to achieve the above objective, the inventors conducted extensive studies regarding various factors that influence etching processing such as a chemical composition, a surface roughness, and the residual stress. As a result, it has been found that etching processing with higher precision can be performed, and change in shape after etching can be significantly minimized, and thereby the present invention has been completed.

[0006] The invention is defined in the appended claims.

[Advantageous Effects of Invention]

[0007] According to the present invention having the above features, it is possible to obtain a metal mask material having less change in shape after etching processing, less etching unevenness, and exhibiting excellent etching processability.

[Description of Embodiments]

[0008] Hereinafter, the present invention will be described in detail. Here, a metal mask material of the present invention includes a steel strip wound in a coil shape and a rectangular thin plate produced by cutting the steel strip.

[0009] The reasons why the metal mask material of the present invention is an Fe-Ni alloy having a chemical composition including, by mass%, C: 0.01% or less, Si: 0.5% or less, Mn: 1.0% or less, and Ni: 30 to 50%, with the balance being made up of Fe and inevitable impurities are as follows.

[C: 0.01 mass% or less]

[0010] C is an element that influences etching properties. Since etching properties deteriorate when an excess amount of C is included, the upper limit of C is set to 0.01%. There may be 0% of C, but it is incorporated in a small amount in a production process, and thus the lower limit is not particularly limited.

[Si: 0.5 mass% or less, Mn: 1.0 mass% or less]

[0011] Si and Mn are generally used for the purpose of deoxidation and are contained in a small amount in the Fe-Ni alloy. However, when an excessive amount thereof is contained, since segregation easily occurs, Si: 0.5% or less, and Mn: 1.0% or less are set. Preferably, an amount of Si and an amount of Mn are Si: 0.1% or less, and Mn: 0.5% or less. The lower limits of Si and Mn can be set to, for example, 0.05% for Si and 0.05% for Mn.

[Ni: 30 to 50 mass%]

[0012] Ni is an element that has a function of allowing adjustment of a coefficient of thermal expansion and greatly influences low thermal expansion characteristics. Since there is no effect of lowering a coefficient of thermal expansion when a content is less than 30% or exceeds 50%, a range for Ni is set to 30 to 50%. Preferably, an amount of Ni is 32 to 45%.

[0013] Components other than the above elements are Fe and inevitable impurities.

[0014] First, the metal mask material of the present invention will be described.

(Surface roughness)

[0015] Regarding a surface roughness of a metal mask material of the present embodiment, an arithmetic average roughness Ra (according to JIS-B-0601-2001) is 0.05 to 0.25 μm, and a maximum height Rz (according to JIS-B-0601-2001) is 1.5 μm or less. When Ra and Rz are within the above ranges, the material of the present invention can be etched with high precision. When Ra exceeds 0.25 μm, since the surface of the material is too rough, variations occur during etching, and etching processing with high precision becomes difficult. When Ra is less than 0.05 μm, the adhesion of a resist is likely to be lowered. In addition, when Rz exceeds 1.5 μm even if Ra is within the above range, this is not preferable because a large peak part in a roughness curve is formed in a part of the surface of the material, etching progresses from the peak part and this causes etching unevenness. The upper limit of Ra is more preferably 0.13 μm, and the upper limit of Rz is more preferably 1.0 μm. The lower limit of Rz is not particularly limited.

[0016] However, since there is a possibility of the adhesion of a sheet-like resist being lowered when Rz is too small, the lower limit of Rz is preferably set to 0.3 μm. In addition, in order to minimize local etching unevenness, it is preferable that these restrictions on the surface roughness be satisfied for both a surface roughness in a direction perpendicular to a rolling direction (hereinafter referred to as a "width direction" or "direction perpendicular to a rolling direction") and a surface roughness in the rolling direction (hereinafter referred to as a "longitudinal direction") of the metal mask material. In addition, a difference in Ra between a direction perpendicular to a rolling direction and the rolling direction of the material is preferably adjusted to be less than 0.02 μm. Accordingly, unevenness during etching can be minimized. Here, the surface roughness can be measured using a contact type or non-contact type roughness meter that is generally used.

[0017] The metal mask material of the present embodiment has a skewness Rsk (according to JIS-B-0601-2001) of less than 0 in addition to the above surface roughness. When the above numerical value range is satisfied, since the roughness curve of the surface of the material is wider at the peak part than at the valley part, etching can progress more uniformly. If Rsk>0, a difference in etching progress between the peak part and the valley part of the roughness curve tends to be large. However, when Rsk is less than 0, etching unevenness can be further minimized. This is more conspicuous in a thin plate material in which etching progresses in a short time and the progress of etching is likely to be nonuniform. More preferably, Rsk<-1.0. The lower limit of Rsk is not particularly limited. However, since it is difficult to produce a material having a very small Rsk, the lower limit is preferably set to about -3.0. In addition, a difference in Rsk between the rolling direction and the width direction of the material is preferably 0.7 or less, more preferably 0.5 or less, and most preferably 0.2 or less. Here, Rsk of the present embodiment has a negative value both in a rolling direction and a direction perpendicular to the rolling direction. Here, the metal mask material of the present embodiment is applied to a material with a plate thickness of less than 0.10 mm in order to obtain the above effect of Rsk sufficiently and form patterns with higher definition. Preferably, the plate thickness is less than 0.06 mm, and more preferably, the plate thickness is less than 0.03 mm. The lower limit is not particularly limited. However, since etching becomes difficult when the thickness is too thin, it is set to 0.01 mm.

(Amount of warpage)

[0018] Regarding the metal mask material of the present embodiment, a sample with a length of 150 mm and a width of 30 mm is cut out, the sample is etched from one side, and an amount of warpage when 60% of the plate thickness of the sample is removed is 15 mm or less. As described above, even if the vicinity of the center of the plate thickness in which the balance of the stress further breaks down is etched, by reducing the residual stress, it is possible to minimize deformation and etching processing can progress favorably. Therefore, half etching with various depths can be performed and it is possible to increase a degree of freedom of etching pattern. Preferably, an amount of warpage when any of 20%, 30%, and 50% of the plate thickness of the sample is removed is 15 mm or less. More preferably, amounts of warpage when any of 20, 30, and 50% of the plate thickness of the sample is removed are all 15 mm or less. In addition, the amount of warpage is preferably 13 mm or less, more preferably 11 mm or less, and still more preferably 9 mm or less. Most preferably, an amount of warpage when 50% of the plate thickness of the sample is removed, in which the balance of the stress easily breaks down and large warpage is likely to occur, is 9 mm or less, and an amount of warpage when 20% or 30% of the plate thickness is removed is preferably 6 mm or less. In the present embodiment, the sample is cut so that a length direction of the cut sample corresponds to the rolling direction, and the warpage is measured. Here, in a method of measuring an amount of warpage in the present embodiment, after removal by etching from one side of a sample, the sample is hung of which an upper end of the cut sample is in contact with a vertical surface plate, and a horizontal distance between a lower end of the cut sample separated from the vertical surface plate due to warpage and the vertical surface plate is measured as an amount of warpage.

[0019] Subsequently, a production method of a metal mask material of the present embodiment will be described.

[0020] In the production method of the present embodiment, for example, processes of vacuum melting-hot forging-hot rolling-cold rolling can be applied. As necessary, a homogenization heat treatment is performed at about 1,200 °C in a step before cold rolling, and during the cold rolling process, in order to reduce the hardness of the cold rolled material, annealing at 800 to 950 °C can be performed at least once. In the cold rolling process, a polishing process of removing scale on the surface and an ear trimming process of removing an off-gauge part (a part with a thick plate thickness) at the end of the material and removing an ear wave part generated in rolling processing may be performed. As a furnace used during the heat treatment process, existing furnaces such as a vertical type furnace and a horizontal type furnace (a horizontal furnace) may be used. However, in order to prevent breaking while passing a plate through and further increase the steepness of the material, a vertical type furnace in which deflection due to an own weight is unlikely to occur is preferably used.

[0021] In the production method of the present embodiment, a rolling reduction ratio in a final pass of a finish cold rolling process is adjusted to 35% or less. When the rolling reduction ratio exceeds 35%, the residual distortion of the material increases and the occurrence of deformation during etching processing tends to increase. Preferably, the upper limit of the rolling reduction ratio is 15%, more preferably the upper limit of the rolling reduction ratio is 10%, and most preferably, the upper limit of the rolling reduction ratio is 6%. Here, since it is difficult to adjust the surface roughness to be in the above range, and slipping easily occurs between a rolling machine and the material when the rolling reduction ratio is excessively low, the lower limit of the rolling reduction ratio is set to 2%. Here, the number of rolling passes in the finish cold rolling is not particularly specified. However, for example, in order to prevent cracks and the like that are likely to occur when a thin material with a plate thickness of less than 0.1 mm is processed, a rolling pass may be performed a plurality of times (for example, 3 times or more, preferably 4 times or more, and more preferably 5 times or more). In addition, these restrictions on the rolling reduction ratio are preferably applied to all passes of the finish cold rolling.

[0022] In the production method of the present embodiment, as a roller used in the final pass of the finish cold rolling, a roller having a surface roughness Ra of 0.05 to 0.25 μm in a direction perpendicular to a circumferential direction (a direction in which a roller rotates) of the roller is used. Preferably, the upper limit of Ra is 0.15 μm. Thereby, a desired roughness can be imparted to the metal mask material. Here, the material of the roller is not particularly limited. For example, an alloy tool steel roller defined in JIS-G4404 can be used.

[0023] In the production method of the present embodiment, in the finish cold rolling, a bite angle which is an angle at which the rolled material and a work roller start to come in contact with each other is set to less than 1.0°. When the bite angle is adjusted to be within the above numerical value range, a rolling oil is intentionally introduced between the rolled material and the work roller, and an uneven part on the surface of the work roller is prevented from being excessively transferred to the rolled material. Accordingly, a difference between a surface roughness in a direction perpendicular to a rolling direction and a surface roughness in the rolling direction of the metal mask material is reduced and Rsk can be easily adjusted to have a negative value more reliably. In addition, when a rolling oil is introduced between the work roller and the rolled surface of the material, Rsk of the surface of the material is adjusted to less than 0 and a metal mask material having more favorable etching processability can be obtained. In addition, when it is desired to reliably adjust Rsk to have a negative value, the bite angle is preferably adjusted to less than 0.4°. Here, since there is a possibility of the occurrence of slipping, the occurrence of poor shape adjustment, or the like, when the bite angle is too small, the lower limit can be set to 0.05°. In addition, these restrictions on the bite angle are preferably applied to all passes of the finish cold rolling. Here, when the bite angle is θ in the present embodiment, the bite angle can be derived from a calculation formula $\theta=180/\pi\cdot\arccos((R-(h_0-h_1)/2)/R)$. Here, R indicates the radius of the roller, ho indicates the plate thickness of the material before rolling, and hi indicates the plate thickness of the material after rolling.

[0024] In the production method of the present embodiment, a rolling speed is preferably set to 60 m/min or more. When the rolling speed is set to 60 m/min or more, a rolling oil is reliably introduced between the work roller and the metal mask material, and an oil pit for adjusting Rsk to have a negative value can be formed more reliably. More preferably, the lower limit of the rolling speed is 80 m/min. Here, the upper limit of the rolling speed is not particularly set, but if the rolling speed is too fast, a large amount of rolling oil is introduced between the work roller and the material, and it is conceivable that there would be a possibility of slipping failure. Therefore, for example, 300 m/min can be set.

[0025] In the production method of the present embodiment, distortion relief annealing may be performed in order to remove distortion remaining in the metal mask material after finish rolling and minimize shape defects occurring in the material. The distortion relief annealing is preferably performed at a temperature of about 400 to 700 °C. Here, an annealing time is not particularly limited. However, when the time is too long, characteristics such as the tensile strength significantly deteriorate, and when the time is too short, an effect of removing the distortion is not obtained. Therefore, about 0.5 to 2.0 min is preferable.

Examples

[0026] The present invention will be described in further detail with reference to the following examples. Chemical compositions of metal mask materials of this example are shown in Table 1. An Fe-Ni alloy of this example was subjected to a finishing process to have a thickness of 2 to 3 mm according to vacuum melting-hot forging-homogenization heat treatment-hot rolling, and was then subjected to cold rolling. The Fe-Ni alloy after hot rolling was subjected to cold rolling including annealing twice, and an Fe-Ni alloy cold rolled material was produced. The thickness of the Fe-Ni alloy cold rolled materials before the final pass of the finish cold rolling were 0.0208 mm (sample No. 1) and 0.054 mm (sample No. 2), respectively, and rolling conditions were adjusted so that sample No. 1 had a thickness of 0.020 mm (a rolling reduction ratio of 4%) after the finish cold rolling and sample No. 2 had a thickness of 0.050 mm (a rolling reduction ratio of 7%) after the finish cold rolling. In this case, a bite angle of the roller of sample No. 1 was 0.26° and the number of passes during finish rolling was 7. In addition, a bite angle of the roller of sample No. 2 was 0.51°, and the number of passes during finish rolling was 4. In addition, in sample No. 1 and sample No. 2, a rolling speed during the finish cold rolling was an average of 80 m/min. In addition, a roughness Ra in a direction perpendicular to a circumferential direction (a direction in which a roller rotates) of the roller used for finish cold rolling was in a range of 0.05 to 0.2 μm. After the finish cold rolling, distortion relief annealing was performed at a temperature of 500 °C for 1 minute.

[Table 1]

(mass%)					
Sample No.	C	Si	Mn	Ni	Balance
1	0.003	0.023	0.27	35.7	Fe and inevitable impurities
2	0.002	0.023	0.29	36.0	Fe and inevitable impurities

[0027] Subsequently, a surface roughness and a warpage of the obtained sample were measured. Surface roughnesses Ra, Rz, and Rsk were measured according to measurement methods shown in JIS B0601 and JIS B0651, three places were randomly selected, and surface roughnesses were measured in the longitudinal direction and the width direction. A stylus type roughness meter was used as a measurement device and measurement was performed under conditions of an evaluation length of 4 mm, a measurement speed of 0.3 mm/s, and a cutoff value of 0.8 mm. Table 2 shows average values at three places. In addition, for measurement of warpage, a cut sample with a length of 150 mm and a width of 30 mm was prepared, and etched from one side so that the plate thickness became 2/5, and an amount of warpage when the cut sample was hung on a vertical surface plate was then measured and evaluated. Here, the cut sample was collected from the central part in the width direction of the prepared sample so that the length direction corresponded to the rolling direction. A ferric chloride aqueous solution was used as an etching solution, and the etching solution with a liquid temperature of 50 °C was sprayed thereon, and thus a test piece corroded. The results are shown in Table 2.

[Table 2]

Sample No.	Surface roughness						Amount of warpage (mm)
	Ra (μm) Rz (μm) Rsk						
	Width direction	Longitudinal direction	Width direction	Longitudinal direction	Width direction	Longitudinal direction	
1	0.11	0.11	0.74	0.70	-1.7	-1.5	3
2	0.11	0.09	0.83	0.66	-0.5	-0.8	10

[0028] According to the results in Table 2, it was confirmed that the metal mask material of the present invention had an optimal surface state such that it exhibited favorable etching processability, and it was possible to minimize change in shape after deep etching exceeding half of the plate thickness.

(Example 2)

[0029] Next, a plurality of cut samples with a length of 150 mm and a width of 30 mm in sample No. 1 were prepared, samples Nos. 3 to 5 as examples of the present invention in which an amount of removal due to etching was changed as shown in Table 3 were prepared and an amount of warpage was measured. A method of measuring an amount of warpage and an etching solution used were the same as those used in Example 1. The results are shown in Table 3.

[Table 3]

Sample No.	Amount of removal due to etching (with respect to initial plate thickness)	Amount of warpage (mm)
3	20%	3
4	30%	3
5	50%	3

[0030] According to the results in Table 3, it was confirmed that, even if an etching depth was changed, it was possible to minimize an amount of warpage in the metal mask material of the present invention. In particular, when an amount of the material removed due to etching was 50% of the plate thickness, the balance between the compressive residual stress and the tensile residual stress broke down, and excess warpage was likely to occur, but excess warpage did not occur in the material of the example of the present invention.

Claims

1. A metal mask material, the metal mask material is **characterised by** including, by mass%, C: 0.01% or less, Si: 0.5% or less, Mn: 1.0% or less, and Ni: 30 to 50%, with the balance being made up of Fe and inevitable impurities, wherein for the metal mask material, both a surface roughness in a rolling direction and a surface roughness in a direction perpendicular to the rolling direction have an arithmetic average roughness Ra of 0.05 μm or more and 0.25 μm or less and a maximum height Rz of 1.5 μm or less, and a skewness Rsk is less than 0, and

wherein, when a sample with a length of 150 mm and a width of 30 mm is cut out from the metal mask material and 60% of the plate thickness of the sample is removed by etching the sample from one side, an amount of warpage is 15 mm or less, and the plate thickness is 0.01 mm or more and less than 0.10 mm.

2. The metal mask material according to claim 1,
wherein the skewness Rsk is -3.0 or more

3. The metal mask material according to claim 1 or 2,
wherein a difference between a skewness Rsk in a rolling direction of the metal mask material and a skewness Rsk in a direction perpendicular to the rolling direction is 0.7 or less.

4. The metal mask material according to any one of claims 1 to 3,
wherein a difference between a surface roughness Ra in the rolling direction of the metal mask material and a surface roughness Ra in the direction perpendicular to the rolling direction is less than 0.02 μm.

5. The metal mask material according to any one of claims 1 to 4,
wherein, when a sample with a length of 150 mm and a width of 30 mm is cut out from the metal mask material and any of 20%, 30%, and 50% of the plate thickness of the sample is removed by etching the sample from one side, an amount of warpage is 15 mm or less.

6. A production method of a metal mask material, the production method of a metal mask material is **characterised by** cold rolling a cold rolling material including, by mass%, C: 0.01% or less, Si: 0.5% or less, Mn: 1.0% or less, and Ni: 30 to 50%, with the balance being made up of Fe and inevitable impurities to obtain a metal mask material, wherein:

conditions in a final pass of a finish cold rolling process for the cold rolling material are that a rolling reduction ratio is 35% or less and 2% or more and a bite angle of a rolling roller is less than 1.0° and a surface roughness in a direction perpendicular to a circumferential direction of a roller has an arithmetic average roughness Ra of 0.05 to 0.25μm;
for the metal mask material, both a surface roughness in a rolling direction and a surface roughness in a direction perpendicular to the rolling direction have an arithmetic average roughness Ra of 0.05 μm or more and 0.25 μm or less and a maximum height Rz of 1.5 μm or less, and a skewness Rsk is less than 0;
when a sample with a length of 150 mm and a width of 30 mm is cut out from the metal mask material and 60% of the plate thickness of the sample is removed by etching the sample from one side, an amount of warpage is 15 mm or less; and
the plate thickness of the material after finish cold rolling is 0.01 mm or more and less than 0.10 mm.

7. The production method of a metal mask material according to claim 6,
wherein the bite angle of the rolling roller is less than 0.4°.

8. The production method of a metal mask material according to claim 6 or 7,
wherein a rolling reduction ratio in the final pass of the finish cold rolling process is 15% or less.

9. The production method of a metal mask material according to any one of claims 6 to 8,
wherein a rolling speed in the finish cold rolling process is 60 m/min or more.

Patentansprüche

1. Metallmaskenmaterial, wobei das Metallmaskenmaterial **dadurch gekennzeichnet ist, dass** es in Masse-%, C: 0,01 % oder weniger, Si: 0,5 % oder weniger, Mn: 1,0 % oder weniger, und Ni: 30 bis 50 % enthält, wobei der Rest aus Fe und unvermeidbaren Verunreinigungen zusammengesetzt ist,
wobei für das Metallmaskenmaterial sowohl eine Oberflächenrauhigkeit in einer Walzrichtung als auch eine Oberflächenrauhigkeit in einer Richtung senkrecht zu der Walzrichtung eine arithmetische mittlere Rauhigkeit Ra von 0,05 μm oder mehr und 0,25 μm oder weniger und eine maximale Höhe Rz von 1,5 μm oder weniger aufweisen und eine Schrägheit Rsk kleiner als 0 ist, und
wobei, wenn eine Probe mit einer Länge von 150 mm und einer Breite von 30 mm aus dem Metallmaskenmaterial ausgeschnitten wird und 60% der Plattendicke der Probe durch Ätzen der Probe von einer Seite entfernt wird, ein Verzugsmaß 15 mm oder weniger beträgt und die Plattendicke 0,01 mm oder mehr und weniger als 0,10 mm beträgt.

2. Metallmaskenmaterial gemäß Anspruch 1, wobei die Schrägheit Rsk -3,0 oder mehr beträgt.

3. Metallmaskenmaterial gemäß Anspruch 1 oder 2, wobei eine Differenz zwischen einer Schrägheit Rsk in einer Walzrichtung des Metallmaskenmaterials und einer Schrägheit Rsk in einer Richtung senkrecht zu der Walzrichtung 0,7 oder weniger beträgt.

4. Metallmaskenmaterial gemäß irgendeinem der Ansprüche 1 bis 3, wobei eine Differenz zwischen einer Oberflächenrauhigkeit Ra in der Walzrichtung des Metallmaskenmaterials und einer Oberflächenrauhigkeit Ra in der Richtung senkrecht zu der Walzrichtung weniger als 0,02 μm beträgt.

5. Metallmaskenmaterial gemäß irgendeinem der Ansprüche 1 bis 4, wobei, wenn eine Probe mit einer Länge von 150 mm und einer Breite von 30 mm aus dem Metallmaskenmaterial ausgeschnitten wird und eines von 20 %, 30 % und 50 % der Plattendicke der Probe durch Ätzen der Probe von einer Seite entfernt wird, ein Verzugsmaß 15 mm oder weniger beträgt.

6. Verfahren zur Herstellung eines Metallmaskenmaterials, wobei das Verfahren zur Herstellung eines Metallmaskenmaterials **gekennzeichnet ist, durch** Kaltwalzen eines Kaltwalzmaterials, das, in Masse-%, C: 0,01% oder weniger, Si: 0,5% oder weniger, Mn: 1,0 % oder weniger, und Ni: 30 bis 50 % enthält, wobei der Rest aus Fe und unvermeidbaren Verunreinigungen zusammengesetzt ist, um ein Metallmaskenmaterial zu erhalten, wobei
Bedingungen in einer Decklage eines Fertigkaltwalzprozesses für das Kaltwalzmaterial sind, dass ein Walzreduktionsverhältnis 35 % oder weniger und 2 % oder mehr beträgt und ein Bisswinkel einer Walzrolle weniger als 1,0° und eine Oberflächenrauhigkeit in einer Richtung senkrecht zu einer Umfangsrichtung einer Rolle eine arithmetische mittlere Rauhigkeit Ra von 0,05 bis 0,25 μm aufweist;
für das Metallmaskenmaterial sowohl eine Oberflächenrauhigkeit in einer Walzrichtung als auch eine Oberflächenrauhigkeit in einer Richtung senkrecht zur Walzrichtung eine arithmetische mittlere Rauhigkeit Ra von 0,05 μm oder mehr und 0,25 μm oder weniger und eine maximale Höhe Rz von 1,5 μm oder weniger aufweisen und eine Schrägheit Rsk weniger als 0 ist;
wenn eine Probe mit einer Länge von 150 mm und einer Breite von 30 mm aus dem Metallmaskenmaterial ausgeschnitten wird und 60% der Plattendicke der Probe **durch** Ätzen der Probe von einer Seite entfernt wird, beträgt das Verzugsmaß 15 mm oder weniger; und
die Plattendicke des Materials nach dem Fertigkaltwalzen 0,01 mm oder mehr und weniger als 0,10 mm beträgt.

7. Verfahren zur Herstellung eines Metallmaskenmaterials gemäß Anspruch 6, wobei der Bisswinkel der Walzrolle weniger als 0,4° beträgt.

8. Verfahren zur Herstellung eines Metallmaskenmaterials gemäß Anspruch 6 oder 7, wobei ein Walzreduktionsverhältnis in dem letzten Schritt des Fertigkaltwalzprozesses 15% oder weniger beträgt.

9. Verfahren zur Herstellung eines Metallmaskenmaterials gemäß irgendeinem der Ansprüche 6 bis 8, wobei die Walzgeschwindigkeit im Kaltfertigwalzprozess 60 m/min oder mehr beträgt.

Revendications

1. Matériau de masque en métal, le matériau de maque en métal est caractérisé comme comprenant, en % en masse : C : 0,01 % ou moins, Si : 0,5 % ou moins, Mn : 1,0 % ou moins et Ni : 30 à 50 %, le reste étant constitué de fer et d'impuretés inévitables,
pour le matériau de masque en métal, une rugosité de surface dans une direction de roulement et une rugosité de surface dans une direction perpendiculaire à la direction de roulement ayant une rugosité moyenne arithmétique Ra de 0,05 μm ou plus et de 0,25 μm ou moins et une hauteur maximum Rz de 1,5 μm ou moins, et une asymétrie Rsk est de moins de 0, et
quand un échantillon avec une longueur de 150 mm et une largeur de 30 mm est découpé du matériau de masque en métal et que 60 % de l'épaisseur de la plaque de l'échantillon est enlevé par gravure de l'échantillon d'un côté, une quantité de déformation est de 15 mm ou moins, et l'épaisseur de la plaque est de 0,01 mm ou plus et de moins de 0,10 mm.

2. Matériau de masque en métal selon la revendication 1, dans lequel l'asymétrie Rsk est de -3,0 ou plus.

3. Matériau de masque en métal selon la revendication 1 ou 2,
dans lequel une différence entre une asymétrie Rsk dans une direction de roulement du matériau de masque en métal et une asymétrie Rsk dans une direction perpendiculaire à la direction de roulement est de 0,7 ou moins.

4. Matériau de masque en métal selon l'une quelconque des revendications 1 à 3,
dans lequel une différence entre une rugosité de surface Ra dans la direction de roulement du matériau de masque de métal et une rugosité de surface Ra dans la direction perpendiculaire à la direction de roulement est de moins de 0,02 μm.

5. Matériau de masque en métal selon l'une quelconque des revendications 1 à 4,
dans lequel, quand un échantillon avec une longueur de 150 mm et une largeur de 30 mm est découpé du matériau de masque en métal et que l'un quelconque de 20 %, 30 % et 50 % de l'épaisseur de la plaque de l'échantillon est enlevé par gravure de l'échantillon d'un côté, une quantité de déformation est de 15 mm ou moins.

6. Procédé de production d'un matériau de masque en métal, le procédé de production d'un matériau de masque en métal est **caractérisé par** un roulement à froid d'un matériau de roulement à froid comprenant, en % en masse, C : 0,01 % ou moins, Si : 0,5 % ou moins, Mn : 1,0 % ou moins, et Ni : 30 à 50 %, le reste étant constitué de fer et des impuretés inévitables pour obtenir un matériau de masque en métal :

les conditions dans un passage final d'un processus de roulement à froid fini pour le matériau de roulement à froid étant qu'un rapport de réduction de roulement est de 35 % ou moins et de 2 % ou plus et un angle de piqûre d'un rouleur de roulement est de moins de 1° et une rugosité de surface dans une direction perpendiculaire à une direction circonférentielle d'un rouleur ayant une rugosité Ra de moyenne arithmétique de 0,05 à 0,25 μm ;
pour le matériau de masque en métal, une rugosité de surface dans une direction de roulement et une rugosité de surface dans une direction perpendiculaire à la direction de roulement ont une rugosité de moyenne arithmétique Ra de 0,05 μm ou plus et de 0,25 μm ou moins et une asymétrie Rsk est de moins de 0 ;
quand un échantillon avec une longueur de 150 mm et une largeur de 30 mm est découpé du matériau de masque en métal et que 60 % de l'épaisseur de la plaque de l'échantillon est enlevé par gravure de l'échantillon d'un côté, une quantité de déformation est de 15 mm ou moins ; et
l'épaisseur de la plaque du matériau après le roulement à froid fini est de 0,01 mm ou plus et de moins de 0,10 mm.

7. Procédé de production d'un matériau de masque en métal selon la revendication 6,
dans lequel l'angle de piqûre du rouleur de roulement est de moins de 0,4°.

8. Procédé de production d'un matériau de masque en métal selon la revendication 6 ou 7,
dans lequel un rapport de réduction de roulement dans le passage final du processus de roulement à froid fini est de 15 % ou moins.

9. Procédé de production d'un matériau de masque en métal selon l'une quelconque des revendications 6 à 8,
dans lequel une vitesse de roulement dans le processus de roulement à froid fini est de 60 m/min ou plus.

REFERENCES CITED IN THE DESCRIPTION

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