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(54) Aluminum alloy support for lithographic printing plate

(57) Disclosed is an aluminum alloy support for a lithographic printing plate, which is excellent in both fatigue strength and resistance against repeated bending, particularly, irrespective of the rolling direction. The aluminum alloy support contains 0.20-0.50 wt% of Fe, 0.05-0.20 wt% of Si, and 5-300 ppm of Cu, the balance being Al and inevitable impurities, wherein an aspect ratio of each of crystal grains in a micro-surface structure is within a range of 6 to 30. Further, in the aluminum alloy support, the yield strength is within a range of 145 to 190 N/mm^2, the fatigue strength is within a range of 4 $\times$ 10^4 or more, and the number of repetitions of bending is 8 times or more.

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Description

BACKGROUND OF THE INVENTION

The present invention relates to an aluminum alloy support for a lithographic printing plate, and particularly to an aluminum alloy support for a planographic printing plate, which is suitable for electrochemical surface roughening and is excellent in fatigue strength and resistance against repeated bending.

A planographic printing plate (including an offset form plate) is represented by a so-called PS (Pre-Sensitized) form plate. The PS form plate is produced by a method wherein the surface of an aluminum alloy made base body is roughened, followed by surface treatment such as anode oxidation as needed, and coated with a photosensitive paint and dried. In the case of using the PS form plate for printing, the surface of the PS form plate is generally subjected to image exposure, development, coating of gum, and the like. In these steps, a photosensitive layer insoluble and remaining on the surface at the development step forms an image portion, and an area in which the photosensitive layer is removed and the surface of the aluminum layer is exposed at the development step is hydrophilic and forms a non-image portion as a water receptive portion.

A base body of such a planographic printing plate is generally formed of an aluminum alloy plate which is lightweight and excellent in surface treatment ability and workability. Conventionally, as a material of the base body, there has been used a rolled aluminum alloy plate (thickness: about 0.1-0.5 mm) specified, for example, under JIS A1050, JIS A1100 or JIS A3003. In the case of such a rolled aluminum alloy plate for a planographic printing plate, it is subjected to surface roughening, followed by anode oxidation as needed. Various aluminum alloy made planographic printing plates have been known. One plate is subjected to mechanical surface roughening, chemical etching, and anode oxidation in this order as described in Japanese Patent Laid-open No. Sho 48-49501. Another plate is subjected to electrochemical treatment, post-treatment, and anode oxidation in this order as described in Japanese Patent Laid-open No. Sho 51-146234. A further plate is subjected to chemical etching and anode oxidation in this order as described in Japanese Patent Publication No. Sho 48-28123. An additional plate is subjected to mechanical surface roughening, following by the treatments described in the above document, Japanese Patent Publication No. Sho 48-28123.

In summary, a planographic printing plate is produced from an aluminum alloy for a base body by roughening the surface of the plate using either or combination of two kinds or more of mechanical, chemical, and electrochemical surface roughening processes; forming an anode oxide film of 0.5-3 μm in thickness on the roughened surface for improving printing characteristics; coating the surface with a photosensitive paint and drying the paint; and subjecting the surface of the plate to planographic form-plate preparing treatments such as exposure and development. The form plate thus obtained is wound around a plate cylinder of a printing press with both ends thereof being fixed by mechanical gripping. Thus, ink is allowed to adhere on an image portion of the plate form under the presence of dampening water, being transferred on a rubber blanket, and is printed on a paper surface.

Recently, the printing speed significantly increases with the advance of the printing technique, and to increase the printing speed, there is a tendency to apply a large stress on both ends of a form plate mechanically fixed on a plate cylinder of the printing press. As a result, if the aluminum alloy form plate is insufficient in strength, both the ends of the form plate fixed to the plate cylinder are deformed or broken, causing a failure such as printing deviation; or the form plate is cut at the grip portions due to stress repeatedly applied to the bending portions at both the ends of the form plate, causing interruption of printing.

As is well known, in the case of a typical JIS A1050 based aluminum alloy plate, the uniformly roughened surface and the suitable surface roughness can be obtained by electrochemical surface roughening; and also a non-image portion shows ink repellent property during printing, that is, the water receptivity is excellent. However, the above aluminum alloy plate is poor in fatigue strength, particularly, in the case where the plate is fixed in the direction perpendicular to the rolling direction, so that there arises a problem that the interruption of printing frequently occurs due to the above-described failure in gripping.

SUMMARY OF THE INVENTION

In view of the foregoing, the present invention has been made, and an object of the present invention is to provide an aluminum alloy support for a lithographic printing plate, which is excellent in both fatigue strength and resistance against repeated bending, particularly, irrespective of the fixed direction against the rolling direction; excellent in suitability for surface roughening (particularly, capable of obtaining a uniformly roughened surface and a suitable surface roughness by electrochemical surface roughening); and excellent in water receptivity.

To solve the above problem, the present inventors have experimentally examined a means for improving the fatigue strength of a JIS A1050 based aluminum alloy excellent in electrochemical surface roughening property and water receptivity, and found that the fatigue strength and resistance against repeated bending are closely related to not only the composition of the alloy but also shapes of crystal grains of the surface of the plate and mechanical properties of the plate.

According to a first aspect of the present invention, there is provided an aluminum alloy support for a lithographic printing plate, which is excellent in strength, surface treatment ability, and water receptivity, said aluminum alloy support containing: 0.20-0.50 wt% of Fe, 0.05-0.20 wt% of Si, and 5-300 ppm of Cu, the balance being Al and inevitable impurities, wherein a ratio between the maximum length and the maximum width of each of crystal grains in a micro-surface structure of said aluminum alloy support is within a range of 6 to 30.

According to a second aspect of the present invention, there is provided an aluminum alloy support for a lithographic printing plate, which is excellent in strength, surface treatment ability, and water receptivity, said aluminum alloy support containing: 0.20-0.50 wt% of Fe, 0.05-0.20 wt% of Si, and 5-300 ppm of Cu, the balance being Al and inevitable impurities, wherein a ratio between the maximum length and the maximum width of each of crystal grains in a micro-surface structure of said aluminum alloy support is within a range of 6 to 30, and the yield strength of said aluminum alloy support is within a range of 145 to 190 N/mm^2, the fatigue strength thereof is within a range of 4×10^4 or more, and the number of repetitions of bending thereof is 8 times or more.

The reason why components of the aluminum alloy support for a lithographic printing plate is limited will be described.

Si:

When the content of Si is less than 0.05 wt%, the surface treatment ability is poor, and thereby the uniformity of the roughened surface obtained by electrochemical surface roughening is deteriorated. When it is more than 0.20 wt%, the tone of the surface after surface roughening is excessively blackened resulting in the lost commercial value, and also the uniformity of the roughened surface is reduced and the water receptivity is reduced. Accordingly, the content of Si is required to be within a range of 0.05 to 0.20 wt%.

Fe:

When the content of Fe is less than 0.20 wt%, the tone of the surface after electrochemical surface roughening becomes uneven and also the mechanical strength is reduced. When it is more than 0.50 wt%, the water receptivity is reduced, and the tone of the surface after surface roughening is excessively blackened resulting in the lost commercial value. Accordingly, the content of Fe is required to be within a range of 0.20 wt% to 0.50 wt%.

Cu:

Cu is an element of making fine pits generated by electrochemical surface roughening, thereby improving the surface treatment ability. When the content of Cu is less than 5 ppm (0.0005 wt%), the effect of making fine the pits is insufficient. When it is more than 300 ppm (0.03 wt%), the uniformity of the roughened surface by electrochemical surface roughening is reduced and also the water receptivity is reduced. Accordingly, the content of Cu is required to be within a range of from 5 to 300 ppm.

In the aluminum alloy support, the balance may be basically Al and inevitable impurities. However, in a general aluminum alloy, a small amount of Ti is sometimes added singly or in combination with a trace of B for refinement of the crystal structure of the ingot thereby improving the texture of the rolled plate and preventing occurrence of streaks thereof. For this reason, in the aluminum alloy used for a base body of a lithographic printing plate according to the present invention, 0.003-0.05 wt% of Ti may be added singly or in combination with 1-50 ppm of B. When the content of Ti is less than 0.003 wt% or the content of B is less than 1 ppm, the above effect cannot be achieved. When the content of Ti is more than 0.05 wt%, the additional effect of Ti is saturated resulting in the lost economical effect, and when the content of B is more than 50 ppm, not only the additional effect of B is saturated but also linear defects due to coarsened TiB_2 particles tend to be generated.

To keep characteristics of the aluminum alloy used for a lithographic printing plate, the amount of impurities may be set to be within ranges specified under JIS 1050 (Mn: 0.05 wt% or less, Mg: 0.05 wt% or less, Zn: 0.05 wt% or less, and the other elements: 0.05 wt% or less).

To certainly prevent both ends of a planographic printing plate fixed to a plate cylinder from being cut or deformed/broken due to repeated bending stress generated at high speed printing, the aluminum alloy support of the present invention used for a base body of the planographic printing plate is required to have the number of repetitions of bending in a range of 8 times or more and the fatigue strength in a range of 4×10^4 or more. To achieve the number of repetitions of bending and fatigue strength described above, not only the composition of the plate but also shapes of crystal grains in micro-surface structure of the plate must be suitably adjusted. More specifically, a ratio between the maximum length and the maximum width (so called aspect ratio) of each of crystal grains of the surface of the plate is required to be within a range of 6 to 30, preferably, 8 to 30. This improves the fatigue strength to a value of 4×10^4 or more. When the aspect ratio is less than 6, a sufficient fatigue strength cannot be obtained; while when it is more than 30, the resistance against repeated bending is reduced, that is, the number of repetitions of bending is difficult to be stably more than 8 times. Further, the yield strength exerts an effect on the fatigue strength. For the yield strength in a range of from 145 to 190 N/mm^2, the fatigue strength is compatible with the resistance against repeated bending. When the yield strength is less than 145 N/mm^2, the fatigue strength is less than 4×10^4; while when it is more than 190 N/mm^2, the resistance against repeated bending is reduced and it is difficult for the number of repetitions of bending to exceed 8 times, that is, the target number specified in the present invention. As a result, in the present invention, the aspect ratio of each of crystal grains of the micro- surface structure is required to be within a range of 6 to 30, and the yield strength is required to be within a range of 145 to 190 N/mm^2.

The number of repetitions of bending is evaluated by a manner of repeatedly performing 90° bending right and left by a pressing bend method, and counting the number of bending until there occur cracks at the bending portion as the number of repetitions of bending. In this case, the number of bending is counted for each 90° bending, that is, for not only 90° forward bending but also 90° backward (return) bending after 90° forward bending. On the other hand, the fatigue strength is evaluated by a manner of repeatedly applying a tensile load of 5 kg/mm^2 at a frequency of 25 Hz on one end of a test piece bent at 30° at a corner of 2 mmR, and counting the number of repetitions of applied load until the test piece is fractured. That is, the fatigue strength is expressed by the number of repetitions of applied load.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, there will be described a typical process of producing an aluminum alloy support used as a base body of a lithographic printing plate.

The molten metal of the aluminum alloy having the above-described composition is cast by a known process. An ingot thus obtained is heated and is subjected to hot rolling, followed by cold rolling, to be formed into a plate of 0.10 to 0.50 mm in thickness. In the hot rolling and cold rolling steps, at least a surface layer of the rolled plate is required to be recrystallized at least one time in a period from the ending of hot rolling to completion of cold rolling. The rolled plate may be recrystallized at the ending of hot rolling by making use of the ending temperature of hot rolling; or it may be subjected to recrystallization annealing in a period after hot rolling and before cold rolling or in the midway of cold rolling. In the case where recrystallization is performed by making use of the ending temperature of hot rolling, the ending temperature of hot rolling is preferably set at a value of 280°C or more. Besides, in the case where recrystallization annealing is performed in a period after hot rolling and before cold rolling or in the midway of cold rolling, it is preferably performed at a temperature of 280 to 450°C for a time of 0.5 to 24 hr for batch annealing, and performed at a temperature of 350 to 600°C for a time of 0 to 5 min for continuous annealing.

The reduction ratio of the plate in cold rolling after recrystallization is preferably set at a value of 80 to 95%. By final cold rolling of the plate at a reduction ratio of 80-95% after recrystallization, an aspect ratio of each of crystal grains of the surface of the rolled plate is easily adjusted to be within a range of 6 to 30 and also a yield strength of the rolled plate is easily adjusted to be within a range of 145 to 190 N/mm^2. When the reduction ratio of the plate in cold rolling after recrystallization is less than 80%, the aspect ratio tends to be less than 6 and the yield strength is difficult to be stably more than 145 N/mm^2; while when it is more than 95%, the aspect ratio possibly exceeds 30.

The description of the above production process is illustrative purpose only, and it is to be understood that many changes in production process and production condition may be made insofar as the composition, aspect ratio of crystal grains, and yield strength of the aluminum alloy support are within the ranges specified in the present invention.

Next, there will be described in detail a method of producing a planographic printing plate by treating the aluminum alloy support thus obtained. In addition, the following method is only a typical example, and therefore, the present invention is not limited thereto.

The surface of the aluminum alloy support is preferably cleaned with trichloroethylene, sodium hydroxide or the like for removing fat and oil, rust, contamination, and the like adhering on the surface. After the surface is cleaned by alkali etching using sodium hydroxide, it is subjected to desmutting for removing smut generated by alkali etching. The desmutting treatment is performed by, for example, dipping the plate in a sulfuric acid or nitric acid of 10 to 30 wt%. The surface thus cleaned is then roughened by a mechanical surface roughening process, electrochemical surface roughening process, or chemical surface roughening process. The mechanical surface roughening process is represented by a brush grain process using a rotating nylon brush and abrasives (alumina, silica sand, or the like). The electrochemical surface roughening process is generally performed by electrolyzing the surface of the plate in a solution containing hydrochloric acid or nitric acid in an amount of 2-40 g/l at a temperature of 20 to 70°C. In this case, the electrolytic solution may contain an aluminum salt of the above acid, inorganic acid, amine, carboxylic acid, and the like. In the electrolytic surface roughening, when the concentration of the electrolytic solution is less than 2 g/l or less, the surface roughening becomes difficult; while when it is more than 40 g/l, the degree of surface roughening becomes uneven to such an extent as to be inconvenient for the form plate. The waveform of a current used for the electrolytic surface roughening may include a commercial A. C., sine wave A. C, rectangular wave, parallelopiped wave, and the like. The current density is preferably set to be within a range of 10 to 100 A/mm^2. The roughened surface state obtained by electrolytic surface roughening can be adjusted by control of requirements such as the composition and temperature of electrolytic solution; density, waveform, and amount of a current used for electrolysis; and the flow rate of electrolytic solution. As a result, it is possible to easily obtain desired printing characteristics by suitably controlling these requirements. Besides, the chemical surface roughening process is performed by etching the surface of the plate with sodium hydroxide, sodium fluoride or the like. The residue adhering on the surface thus roughened can be removed by a process described in USP 3,834,998. It is to be noted that either of the processes described above may be basically used for surface roughening; however, the electrochemical surface roughening process is particularly preferable for the aluminum alloy having the composition specified in the present invention.

The surface of the aluminum alloy support, which has been roughened as described above, is then subjected to anode oxidation by a known process. The anode oxidation may be performed in an electrolytic solution of sulfuric acid, phosphoric acid, oxalic acid, chromic acid, amidosulfonic acid, or the like containing an aluminum salt using direct current, alternating current, superimposed alternating current on direct current, pulsed direct current, or the like. In this anode oxidation, the concentration of the electrolytic solution may be within a range of 1 to 80 wt%; the temperature thereof may be within a range of 5 to 70°C; the current density may be within a range of 0.5 to 60 A/dm^2; and the weight of an oxide film may be within a range of 0.5 to 5 g/m^2.

The aluminum alloy support, which has been subjected to anode oxidation, may be subjected to hydrophilic treatment by a method described in USP 2,714,066, GB 1,203,447, or USP 3,181,461. Further, the aluminum alloy support may be formed, as needed, with an under coat layer in an amount of 5 to 30 mg/m^2 using an organic sulfonic acid (described in Japanese Patent Laid-open No. Sho 63-145092); a compound containing carboxylic acid and a phosphoric acid group (described in Japanese Patent Laid-open No. Sho 63-145092); a compound containing one amino group and one oxygen acid group of phosphorus (described in Japanese Patent Laid-open No. Hei 3-261592); or a phosphate (described in Japanese Patent Laid-open No. Hei 3-215095).

To produce a planographic printing plate using the aluminum alloy support having been treated as described above, the surface of the aluminum alloy support is required to be provided with a photosensitive layer. Specific examples of the photosensitive layers may include the following layers (1) to (4).

(1) Photosensitive Layer Containing O-naphthoquinonediazido Sulfonate and Phenol-cresol Mixed Novolac Resin

For example, there may be effectively used compounds described in USP 2,766,118, 2,767,092, 3,636,709, 3,759,711, and 4,028,111, and GB 1,494,043.

(2) Photosensitive Layer Having Diazo Resin and Water-insoluble and ink receptive High-molecular weight Compound

For example, there may be desirably used a diazo resin of a condensate of P-diazophenylamine and formaldehyde or acetaldehyde and hexafluorophosphate, and diazo compounds described in USP 3,300,309 and Japanese Patent Laid-open No. Sho 54-19773.

(3) Photosensitive Layer Containing Photodimerization Type Photosensitive Layer Composition and Photopolymerization Type Photosensitive Layer Composition

Specific examples of photodimerization type photosensitive layer compositions may include polymers each having a maleimide group at a side chain or main chain described in USP 4,078,041 and DE 2,626,769. Specific examples of photopolymerization photosensitive layer compositions may include polymers each having a cinnamyl group, cinnamoyl group or chalcone group at a side chain or main chain. For example, a photosensitive polyester described in USP 3,030,208 or 828,455 is used as the photopolymerization photosensitive layer composition. Further, there may be effectively used an alkali-soluble polymer converted from each of the above polymers, which is described in Japanese Patent Laid-open No. Sho 60-191244.

(4) Photosensitive Layer for Electrophotography

For example, there may be used ZnO photosensitive layers for electrophotography, which are described in USP 3,001,872, and Japanese Patent Laid-open Nos. Sho 56-161550, Sho 60-186847, and Sho 61-238063.

Each of the above-described photosensitive layers may be added with, as needed, a binder described in USP 4,028,111 or 3,751,257; a dye described in Japanese Patent Laid-open No. Sho 62-293247; an affinitizing agent described in Japanese Patent Laid-open No. Sho 55-527 and Hei 2-96756; a non-ionic surface-active agent described in Japanese Patent Laid-open No. Sho 62-251740; and a photooxidizing agent for visualizing an image after exposure represented by O-naphthoquinonediazido-4-sulfonyl chloride or trihalomethyloxathiazole, which is described in Japanese Patent Laid-open Nos. Sho 53-36223 or Sho 63-58440. The photosensitive layer may be formed on the aluminum alloy support in an amount (weight after drying) of 0.8 to 6 g/m^2.

A mat layer composed of independent projections may be provided on the photosensitive layer thus coated on the surface of the aluminum alloy support, as described in Japanese Patent Laid-open Nos. Sho 55-12974 and Sho 58-182636. Further, there may be adopted a method of covering the back surface opposed to the surface coated with the photosensitive layer, with a polymer having a glass transition point of 20°C or more, or an inorganic oxide obtained from an organic metal salt by hydrolysis or the like (described in Japanese Patent Laid-open No. Hei 6-35174).

The photosensitive planographic printing plate (PS form plate) thus produced is subjected to exposure of image, followed by development and coating of gum in accordance with a process described in each of USP 4,259,434 and 4,186,006, and Japanese Patent Laid-open Nos. Sho 59-84241, Sho 57-192952 and Sho 62-24263, and is fixed on a plate cylinder for printing.

EXAMPLE

The present invention will be more clearly understood by way of the following example:

An aluminum alloy having a chemical composition shown in Table 1 was melted and was semi-continuously cast into an ingot of 450 mm × 1200 mm × 3500 mm in size. Each surface portion of the ingot was cut off to a depth of 10 mm. The ingot was subjected to soaking, as needed. Then, the ingot was hot-rolled, followed by cold rolling, to be formed into a raw plate (thickness: 0.3 mm) for a base body of a planographic printing plate. In addition, if necessary, the rolled plate was subjected to intermediate annealing in the midway of the cold rolling. The detailed production conditions are shown in Table 2.

Table 1

alloy No.	Fe (wt%)	Si (wt%)	Cu (ppm)	Ti (wt%)	B (ppm)	
①	0.31	0.12	120	0.01	5	inventive composition
②	0.29	0.08	120	0.02	10	inventive composition
③	0.65	0.32	860	0.01	7	comparative composition

Table 2

production No.	alloy No.	soaking	hot rolling starting temperature	hot rolling ending plate thickness	hot rolling ending temperature (surface recrystallization state)	intermediate annealing	
1	①	600°C × 10hr	420°C	3.0 mm	297°C (recrystallization)	not performed	inventive example
2	②	not performed	500°C	3.0 mm	314°C (recrystallization)	not performed	inventive example
3	②	not performed	500°C	5.0 mm	253°C (non-recrystallization)	390°C × 2hr at the stage of 2.5 mm	inventive example
4	①	600°C × 10hr	430°C	3.0 mm	251°C (non-recrystallization)	not performed	comparative example
5	②	600°C × 10hr	430°C	3.0 mm	236°C (non-recrystallization)	500°C × 0sec at the stage of 0.9 mm	comparative example
6	③	600°C × 10hr	420°C	3.0 mm	302°C (recrystallization)	not performed	comparative example

Each of the raw plates obtained in production conditions shown by production Nos. 1 to 6 in Table 2 was subjected to brush grain treatment into a surface roughness of Ra = 0.6 µm. The brush grain treatment was performed in a suspension of purmice/25 wt% of water using a rotating nylon brush. The surface of the raw plate was subjected to preliminary etching in a solution of 10% sodium hydroxide in a condition of 50°C × 1 min, followed by electrolytic surface roughening for 10 sec in a solution of 1% nitric acid at a current density of 30 A/mm^2. Subsequently, the surface of the raw plate was cleaned in a solution of 5% sodium hydroxide in a condition of 35°C × 10 sec, followed by neutralization in 30% sulfuric acid in a condition of 50°C × 20 sec. The surface of the plate thus treated was then subjected to anode oxidation in 15% sulfuric acid. An anode oxide film was formed to a thickness of about 0.7 µm. Next, the following photosensitive layer was provided on the surface of the aluminum alloy support in an amount (weight after drying) of 2 g/m^2.

(photosensitive layer)	
ester compound of naphthoquinone(1,2)-diazido-(2)-5-sulfonic acid chloride and resorcin-benzaldehyde resin	1 part by weight
copolymer condensate of phenol, m-, p-mixed cresol, and formaldehyde	3.5 parts by weight
2-trichloromethyl-5-[β-(2-benzofuryl)vinyl]-1,3,4-oxadiazole	0.03 part by weight
Victorian Pure Blue-BOH (produced by Hodogaya Chemical Co., Ltd)	0.1 part by weight
O-naphthoquinoneazido sulfonate of p-butylphenolaldehyde novolac resin	0.05 part by weight
methyl cellosolve	27 parts by weight

The photosensitive aluminum alloy support thus obtained was exposed to light emitted from a metal halide lamp of 3 kw disposed separately from the plate at a distance of 1 m for 50 sec. The resultant plate was subjected to development in a solution of 3% meta-sodium silicate at 25°C for 45 sec, followed by water-washing and drying, and was coated with gum, to obtain a planographic printing plate. The original form plate thus obtained was mounted on a printing press, and was subjected to printing test.

Each of the inventive plates and comparative plates was examined in terms of mechanical property, aspect ratio of micro-crystal grains of the surface, and surface treatment ability. Also, the form plate obtained using each plate was examined in terms of qualification of the form plate represented by water receptivity at a non-image portion. The results are shown in Table 3. In addition, as the surface treatment ability in Table 3, the suitability for electrochemical surface roughening was evaluated on the basis of the following criterion:

○ : good, △ : medium, X : poor

As the water receptivity, adhesive ink at a non-image portion was visually inspected. The fatigue strength in Table 3 was evaluated by a method of repeatedly applying a tensile load of 5 kg/mm^2 at a frequency of 25 Hz onto one end of a test piece which was bent at an angle of 30° at a corner of 2 mmR and counting the number of repetitions of applied load until the test piece was fractured. The measurement of the fatigue strength was performed along two directions, a (longitudinal) direction parallel to the rolling direction and a (transverse) direction perpendicular to the rolling direction. The fatigue strength over 40,000 times is decided to be preferable.

The number of repetitions of bending in Table 3 was evaluated by a method of holding a test piece between pedestals of 1 mmR, repeatedly bending the test piece right and left with the inner curvature of the bending portion set at 1 mmR, and counting the number of repetitions of bending for each 90° bending until the test piece was fractured. The measurement of the number of repetitions of bending was also performed along two directions, a (longitudinal) direction parallel to the rolling direction and a (transverse) direction perpendicular to the rolling direction. The number of repetitions of bending over 8 times is decided to be preferable. The aspect ratio of crystal grains of the surface was measured using a photograph having a magnification of 25 times.

Table 3

production No.	alloy No.	aspect ratio (length/width) of crystal grains of surface poriton	yield strength (N/mm^2)	fatigue strength		number of repetitions of bending		surface treatment ability	water receptivity
				parallel (times)	perpendicular (times)	parallel (times)	perpendicular (times)		
1	①	11-14	158	52000	56000	12	11	○	○
2	②	12-15	159	63000	60000	11	12	○	○
3	②	10-13	154	58000	58000	11	10	○	○
4	①	29-32	203	73000	71000	7	6	△	○
5	②	3-5	136	31000	22000	13	13	○	○
6	③	10-14	162	50000	60000	8	9	×	×

As shown in Table 3, it is revealed that the aluminum alloy support for a lithographic printing plate according to the present invention provides a form plate excellent in both fatigue strength and resistance against repeated bending even in the directions parallel and perpendicular to the rolling direction (which means that the form plate can be used in a state being disposed in either the longitudinal or transverse direction with respect to the rolling direction), and also excellent in surface treatment ability and water receptivity. On the other hand, it is apparent that the raw plates of Comparative Examples cannot satisfy the requirements specified in the present invention.

Claims

1. An aluminum alloy support for a lithographic printing plate, which is excellent in strength, surface treatment ability, and water receptivity, said aluminum alloy support containing:

   0.20-0.50 wt% of Fe,
   0.05-0.20 wt% of Si, and
   5-300 ppm of Cu,
   the balance being Al and inevitable impurities,

   wherein a ratio between the maximum length and the maximum width of each of crystal grains in a micro-surface structure of said aluminum alloy support is within a range of 6 to 30.

2. An aluminum alloy support for a lithographic printing plate, which is excellent in strength, surface treatment ability, and water receptivity, said aluminum alloy support containing:

   0.20-0.50 wt% of Fe,
   0.05-0.20 wt% of Si, and
   5-300 ppm of Cu,
   the balance being Al and inevitable impurities,

   wherein a ratio between the maximum length and the maximum width of each of crystal grains in a micro-surface structure of said aluminum alloy support is within a range of 6 to 30, and

   the yield strength of said aluminum alloy support is within a range of 145 to 190 N/mm^2, the fatigue strength thereof is within a range of 4×10^4 or more, and the number of repetitions of bending thereof is 8 times or more.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 11 0527

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 652 298 A (FUJI PHOTO FILM CO LTD) 10 May 1995 * Claim 4; Table 4, examples 3 and 4 *	1,2	C22C21/00 B41N1/08
X	DATABASE WPI Section Ch, Week 9638 Derwent Publications Ltd., London, GB; Class G06, AN 96-375435 XP002047779 & JP 08 179 496 A (KOBE STEEL LTD) , 12 July 1996 * Table 1, example X; Table 5, examples E,G-L * * abstract *	1,2	
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X	GB 1 421 710 A (BRITISH ALUMINIUM CO LTD) 21 January 1976 * Alloys A and G; Page 1, line 50 *	1,2	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	21 November 1997	Bjoerk, P

CATEGORY OF CITED DOCUMENTS

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