strongly and a part of the surface treatment solution will be stirred weakly, so it cannot be stirred uniformly, and a plating thickness will not be uniform. Further, according to a way of stirring, there is a case that a turbulent flow is generated in the surface treatment solution, and there is also a problem on a strength of the device.

[0007]

Embodiments of the present invention provide a surface treatment device and a paddle with improved strength and uniform plating thickness by uniformly stirring a surface treatment solution near an object to be plated. In addition, embodiments of the present invention provide a surface treatment method capable of stirring for a long period of time, by uniformizing a plating thickness, and by improving a strength of a paddle. Further, embodiments of the present invention provide a surface treatment device, a surface treatment method, and a paddle capable of decreasing a generation of a turbulent flow in the surface treatment solution.

[0008]

According to a first aspect of the present invention, there is provided a surface treatment device comprising at least one paddle in a plate shape, in a surface treatment tank, for stirring a surface treatment solution near an object to be plated by reciprocally moving the paddle with respect to the object to be plated, wherein the paddle is configured by integrally forming a plurality of square bars provided in a depth direction or a horizontal direction of the surface treatment solution at regular intervals along the object to be plated, and a liquid draining member for draining a liquid is arranged in at least one side of an end of the paddle, wherein a shape of the liquid draining member is a tapered shape or a circular shape in a cross section in a thickness direction of the liquid draining member.

[0009]

In this way, it is possible to provide the surface treatment device with improved strength and uniform plating thickness by uniformly stirring a surface treatment solution near an object to be plated. Further, it is possible to provide the surface treatment device capable of decreasing a generation of a turbulent flow in the surface treatment solution.

[0010]

In the above aspect of the present invention, the shape of the liquid draining member may be a tapered shape or a circular shape in a cross section in a thickness direction of the liquid draining member.

[0011]

In this way, it is possible to decrease a turbulent flow of the surface treatment solution further.

[0012]

In addition, in one embodiment of the present invention, a square bar of the

plurality of square bars is provided with a curved surface with respect to the object to be plated in a cross section in a thickness direction of the square bar, and the curved surface may be provided alternately facing left and facing right with respect to the object to be plated.

[0013]

In this way, it is possible to stir more uniformly by being able to capture the surface treatment solution with respect to both moving directions when reciprocally moving the paddle.

[0014]

In addition, in one embodiment of the present invention, the regular intervals may be formed in a distance of 10 to 30 mm.

[0015]

In this way, it is possible to uniformize a plating thickness more by stirring the surface treatment solution uniformly without shielding the object to be plated.

[0016]

In addition, in one embodiment of the present invention, the square bar may comprise a side of 5 to 10 mm in length.

[0017]

In this way, it is possible to improve a strength and to uniformize a plating thickness by stirring the surface treatment solution more uniformly, as it will be an optimum size for stirring the surface treatment solution.

[0018]

In addition, in one embodiment of the present invention, the curved surface may comprise a radius of 3 to 10 mm.

[0019]

In this way, it is possible to improve a strength and to uniformize a plating thickness by stirring the surface treatment solution more uniformly by capturing the surface treatment solution more efficiently, as it will be an optimum curved surface of the paddle.

[0020]

In addition, in one embodiment of the present invention, a distance between the paddle and the object to be plated may be 10 to 30 mm.

[0021]

In this way, a concern of the paddle contacting the object to be plated will be decreased. In addition, it is possible to prevent a decrease of a stirring force.

[0022]

In addition, in one embodiment of the present invention, it may further comprise a powering means for reciprocally moving the paddle with a stroke of 50 to 200 mm, and

with a moving speed of 35 to 600 mm/s.

[0023]

In this way, it is possible to improve a strength and to uniformize a plating thickness by stirring the surface treatment solution more uniformly, as it will be optimum stroke and moving speed for stirring the surface treatment solution.

[0024]

In addition, in one embodiment of the present invention, the paddle may be arranged at both sides of the object to be plated.

[0025]

In this way, it is possible to uniformize a plating thickness at front and back surfaces of the object to be plated, by stirring the surface treatment solution uniformly at the front and back surfaces of the object to be plated.

[0026]

According to a second aspect of the present invention, there is provided a surface treatment method using at least one paddle in a plate shape for stirring a surface treatment solution near an object to be plated by reciprocally moving the paddle with respect to the object to be plated, wherein the paddle is configured by integrally forming a plurality of square bars provided in a depth direction or a horizontal direction of the surface treatment solution at regular intervals along the object to be plated, and in at least one side of an end of the paddle, a liquid draining member for draining a liquid is arranged, wherein a shape of the liquid draining member is a tapered shape or a circular shape in a cross section in a thickness direction of the liquid draining member.

[0027]

In this way, it is possible to provide the surface treatment method capable of stirring for a long period of time, by uniformizing a plating thickness by uniformly stirring the surface treatment solution near the object to be plated, and by improving a strength of the paddle. Further, it is possible to provide the surface treatment method capable of decreasing a generation of a turbulent flow in the surface treatment solution.

[0028]

According to a third aspect of the present invention, there is provided a paddle in a plate shape for stirring a surface treatment solution near an object to be plated by reciprocally moving the paddle with respect to the object to be plated, wherein the paddle is configured by integrally forming a plurality of square bars provided in one direction at regular intervals along the object to be plated, and a liquid draining member for draining a liquid is arranged in at least one side of an end of the paddle, wherein a shape of the liquid draining member is a tapered shape or a circular shape in a cross section in a thickness direction of the liquid draining member.

[0029]

In this way, it is possible to provide the paddle capable of improving a strength and uniformizing a plating thickness by uniformly stirring the surface treatment solution near the object to be plated. Further, it is possible to provide the paddle capable of decreasing a generation of a turbulent flow in the surface treatment solution.

[0030]

As explained in the above, according to embodiments of the present invention, it is possible to provide the surface treatment device and the paddle with improved strength and uniform plating thickness by uniformly stirring the surface treatment solution near the object to be plated. In addition, it is possible to provide the surface treatment method capable of stirring for a long period of time, by uniformizing a plating thickness, and by improving a strength of the paddle. Further, it is possible to provide the surface treatment device, the surface treatment method, and the paddle capable of decreasing a generation of a turbulent flow in the surface treatment solution.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031]

FIG. 1 is a schematic view illustrating a surface treatment device relating to one embodiment of the present invention viewed from above.

FIG. 2 is a schematic view illustrating a surface treatment device relating to one embodiment of the present invention viewed from a side.

FIG. 3 are views of a paddle relating to one embodiment of the present invention provided with liquid draining members for draining liquid at three sides, and in which a plurality of square bars are provided in a depth direction of the surface treatment solution, and FIG. 3(A) is a schematic view of the paddle viewed from a side, FIG. 3(B) is a sectional view along a line A-A' of FIG. 3(A), and FIG. 3(C) is a sectional view along a line B-B' of FIG. 3(A).

FIG. 4 are views of a paddle relating to one embodiment of the present invention provided with liquid draining members for draining liquid at two sides, and in which a plurality of square bars are provided in a depth direction of the surface treatment solution, and FIG. 4(A) is a schematic view of the paddle viewed from a side, FIG. 4(B) is a sectional view along a line A-A' of FIG. 4(A), and FIG. 4(C) is a sectional view along a line B-B' of FIG. 4(A).

FIG. 5 are views of a paddle relating to one embodiment of the present invention provided with a liquid draining member for draining liquid at one side, and in which a plurality of square bars are provided in a horizontal direction, and FIG. 5(A) is a schematic view of the paddle viewed from a side, FIG. 5(B) is a sectional view along a line A-A' of FIG. 5(A), and FIG. 5(C) is a sectional view along a line B-B' of FIG. 5(A).

CLAIMS

1. A surface treatment device comprising at least one paddle in a plate shape, in a surface treatment tank, for stirring a surface treatment solution near an object to be plated by reciprocally moving the paddle with respect to the object to be plated,

wherein the paddle is configured by integrally forming a plurality of square bars provided in a depth direction or a horizontal direction of the surface treatment solution at regular intervals along the object to be plated, and

a liquid draining member for draining a liquid is arranged in at least one side of an end of the paddle,

wherein a shape of the liquid draining member is a tapered shape or a circular shape in a cross section in a thickness direction of the liquid draining member.

2. The surface treatment device according to claim 1, wherein a square bar of the plurality of square bars is provided with a curved surface with respect to the object to be plated in a cross section in a thickness direction of the square bar, and the curved surface is provided alternately facing left and facing right with respect to the object to be plated.

3. The surface treatment device according to claim 1 or 2, wherein the regular intervals are formed in a distance of 10 to 30 mm.

4. The surface treatment device according to claim 2, wherein the square bar comprises a side of 5 to 10 mm in length.

5. The surface treatment device according to claim 4, wherein the curved surface comprises a radius of 3 to 10 mm.

6. The surface treatment device according to any of claims 1 to 5, wherein a distance between the paddle and the object to be plated is 10 to 30 mm.

7. The surface treatment device according to any of claims 1 to 6, further comprising a powering means for reciprocally moving the paddle with a stroke of 50 to 200 mm, and with a moving speed of 35 to 600 mm/s.

8. The surface treatment device according to any of claims 1 to 7, wherein the paddle is arranged at both sides of the object to be plated.

9. A surface treatment method using at least one paddle in a plate shape for stirring a surface treatment solution near an object to be plated by reciprocally moving the paddle with respect to the object to be plated,

wherein the paddle is configured by integrally forming a plurality of square bars provided in a depth direction or a horizontal direction of the surface treatment solution at regular intervals along the object to be plated, and

a liquid draining member for draining a liquid is arranged in at least one side of an end of the paddle,

wherein a shape of the liquid draining member is a tapered shape or a circular shape in a cross section in a thickness direction of the liquid draining member.

10. A paddle in a plate shape for stirring a surface treatment solution near an object to be plated by reciprocally moving the paddle with respect to the object to be plated,

wherein the paddle is configured by integrally forming a plurality of square bars provided in one direction at regular intervals along the object to be plated, and

a liquid draining member for draining a liquid is arranged in at least one side of an end of the paddle,

wherein a shape of the liquid draining member is a tapered shape or a circular shape in a cross section in a thickness direction of the liquid draining member.