SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] However, the plating apparatus described in Patent Document 1 needs to have the opening and the grooves in the side plate of the tank as well as the tank for accommodating the cathode and anode plates, causing the structure to be larger in size and to be complex, and a manufacturing cost and a material cost to increase accordingly. Therefore, a simpler and more compact plating apparatus has been required.

[0005] Moreover, in the research and development of a plated object in recent years, a plating apparatus has been required that allows for observing production process of a plated object during plating, such as with a high performance microscope (e.g. Raman microscope).

[0006] Embodiments of the present invention seek to provide a plating apparatus that may be simpler and can be easily made smaller in size than before and a sensing device using the same.

Further, embodiments of the present invention seek to provide, a plating apparatus that may allow for observing a production process of a plated object.

MEANS TO SOLVE THE PROBLEMS

[0007] A plating apparatus according to an aspect of the present invention includes: a holding member (2) that holds a plated object (W) specified as a cathode; a spacer (4) that is stacked on the holding member (2) via a first seal member (3) in an annular shape surrounding the plated object (W), and has a through portion (45) from which the plated object (W) is exposed and which stores a plating solution; and an anode member (6) that is stacked on the spacer (4) via a second seal member (5) in an annular shape surrounding the through portion (45), and has an anode layer (62) arranged to face the plated object (W) which is exposed from the through portion (45), wherein the spacer includes a spacer body made of an insulator and an anode-side conductive layer arranged on a face,

which faces the anode member, of the spacer body, the anode member includes an anode member body made of an insulator and an anode layer specified as the anode arranged on a face, which faces the spacer, of the anode member body, the anode-side conductive layer is connected inside the second seal member to the anode layer, and the anode-side conductive layer is connected outside the second seal member to a power supply.

According to a second aspect, there is provided a plating apparatus comprising: a holding member that holds a plated object specified as a cathode; a spacer that is stacked on the holding member via a first seal member in an annular shape surrounding the plated object, and has a through portion from which the plated object is exposed and which stores a plating solution; and an anode member that is stacked on the spacer via a second seal member in an annular shape surrounding the through portion, and has an anode layer arranged to face the plated object which is exposed from the through portion, wherein the anode member includes an anode member body made of an insulator and an anode layer specified as the anode arranged on a face, which faces the spacer, of the anode member body, the anode member body includes a light transmissive window for observing the plated object exposed from the through portion, and the anode layer is formed around the window.

[0017] Still moreover, in a case where the plating solution is an electroless plating solution, a measuring device instead of the power supply (PW) is preferably connected to measure the electric potential across the anode and the cathode.

The structure may allow the plating apparatus (1) according to embodiments of the present invention to apply the electroless plating and to measure the electric potential across the anode and the cathode.

[0018] The present disclosure also provides a sensing device using the above-described plating apparatus (1), wherein the anode-side conductive layer (43) is constituted with a plurality of anode-side conductive layers (43B) insulated from one another, the anode layer (62) is constituted with the same number of anode layers (62B) insulated from one another as the anode-side conductive layers (43B), and portions (62Bb) of anode layers (62B) exposed from the through portion (45) are respectively modified with reaction groups different from one another.

The structure may allow the plating apparatus (1) to be used as a sensing device, for example, by modifying different reaction groups to the plurality of anode layers (62B).

EFFECT OF THE INVENTION

[0019] Embodiments of the present invention can provide a plating apparatus which is simpler and can be easily made smaller in size than before, and a sensing device using the same. Further, embodiments of the present invention can provide a plating apparatus that may allow for observing a production process of a plated object.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. 1 is a perspective view of a plating apparatus according to a first embodiment;

FIG. 2 is an exploded perspective view of the plating apparatus according to the first embodiment;

Claims:

[Claim 1]

A plating apparatus comprising:

a holding member that holds a plated object specified as a cathode;

a spacer that is stacked on the holding member via a first seal member in an annular shape surrounding the plated object, and has a through portion from which the plated object is exposed and which stores a plating solution; and

an anode member that is stacked on the spacer via a second seal member in an annular shape surrounding the through portion, and has an anode layer arranged to face the plated object which is exposed from the through portion,

wherein the the spacer includes a spacer body made of an insulator and an anode-side conductive layer arranged on a face, which faces the anode member, of the spacer body,

the anode member includes an anode member body made of an insulator and an anode layer specified as the anode arranged on a face, which faces the spacer, of the anode member body,

the anode-side conductive layer is connected inside the second seal member to the anode layer, and

the anode-side conductive layer is connected outside the second seal member to a power supply.

[Claim 2]

The plating apparatus according to claim 1, wherein the anode member body includes a light transmissive window for observing the plated object exposed from the through portion, and

the anode layer is formed around the window.

[Claim 3]

The plating apparatus according to claim 2, wherein the window has a thickness smaller than that of other portions of

the anode member body.

[Claim 4]

The plating apparatus according to claim 2 or 3, wherein a thickness t1 of the window is in a range of 0.05 mm ≤ t1 ≤ 2 mm.

[Claim 5]

The plating apparatus according to any one of claims 2 to 4, wherein the anode member body has a tapered portion around the window which declines toward the window.

[Claim 6]

The plating apparatus according to any one of claims 1 to 5, wherein a thickness t2 of the spacer is in a range of 0.05 mm ≤ t2 ≤ 1 mm.

[Claim 7]

The plating apparatus according to any one of claims 1 to 6, wherein the spacer includes a cathode-side conductive layer arranged on a face, which faces the holding member, of the spacer body,

the cathode-side conductive layer is connected inside the first seal member to the plated object, and

the cathode-side conductive layer is connected outside the first seal member to the power supply.

[Claim 8]

The plating apparatus according any one of claims 1 to 7, wherein the spacer includes a reference electrode conductive layer insulated from the anode-side conductive layer on a face, which faces the anode member, of the spacer body,

the anode member includes a reference electrode layer insulated from the anode layer on a face, which faces the spacer, of the anode member body,

the reference electrode conductive layer is connected inside the second seal member to the reference electrode layer,

and

the reference electrode conductive layer is connected outside the second seal member to a measuring device.

[Claim 9]

The plating apparatus according to any one of claims 1 to 8, wherein the holding member or the anode member includes a plating solution supply passage through which a plating solution is supplied to the through portion, and

the holding member or the anode member includes a plating solution discharge passage through which the plating solution is discharged from the through portion.

[Claim 10]

The plating apparatus according to claim 7, wherein the plating solution is an electroless plating solution, and a measuring device instead of the power supply is connected to measure the electric potential across the anode and the cathode.

[Claim 11]

A sensing device having the plating apparatus as set forth in any one of claims 1 to 9,

wherein the anode-side conductive layer is constituted with a plurality of anode-side conductive layers insulated from one another,

the anode layer is constituted with the same number of anode layers insulated from one another as the anode-side conductive layers, and

portions of anode layer which is exposed from the through portion are respectively modified with reaction groups different from one another.

[Claim 12]

A plating apparatus comprising:

a holding member that holds a plated object specified as a cathode;

a spacer that is stacked on the holding member via a first seal member in an annular shape surrounding the plated object, and has a through portion from which the plated object is exposed and which stores a plating solution; and

an anode member that is stacked on the spacer via a second seal member in an annular shape surrounding the through portion, and has an anode layer arranged to face the plated object which is exposed from the through portion,

wherein the anode member includes an anode member body made of an insulator and an anode layer specified as the anode arranged on a face, which faces the spacer, of the anode member body,

the anode member body includes a light transmissive window for observing the plated object exposed from the through portion, and

the anode layer is formed around the window.