ELECTROCHEMICAL PROCESSING SYSTEM

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ABSTRACT
The present invention relates to an electrochemical processing system. The electrochemical processing system comprises a belt electrode and a clean module. The clean module is corresponding to one side of the belt electrode. The electrochemical processing system may be used for cleaning the surface of the belt electrode during an electrochemical process.
Dispose a mask layer on a belt workpiece.

Electrochemically process the belt workpiece using a belt electrode.

Move the belt electrode and clean the surface of the belt electrode mechanically.

Remove the mask layer of the belt workpiece.

FIG. 7
ELECTROCHEMICAL PROCESSING SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates generally to electrochemical processing, and particularly to an electrochemical processing system.

BACKGROUND OF THE INVENTION

[0002] An electrochemical process is a non-traditional processing method capable of processing difficult-to-process metal workpieces. The process is performed in an electrolyte. The metal workpiece acts as the anode whereas the electrode acts as the cathode. An electrochemical process makes use of the principle of dissolving the anode for processing the workpiece. The surface of the workpiece acting as the anode will be ionized into ions and hence removing the workpiece. The ionized ions will enter the electrolyte and form products. The products or impurities will attach to the surface of the electrode and reduce the quality of the electrochemical process. Accordingly, after a certain time of an electrochemical process, the process needs to be stopped for replacing or cleaning the electrode. Consequently, the performance of an electrochemical process will degrade.

SUMMARY

[0003] The present invention discloses an electrochemical processing system, which comprises an electrochemical processing apparatus and a clean module. The electrochemical processing apparatus comprises an electrode transport module and a belt electrode. The belt electrode is disposed at the electrode transport module; the clean module is corresponding to one side of the belt electrode.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. 1 shows a schematic diagram of the electrochemical processing system according to the first embodiment of the present invention;
[0005] FIG. 2 shows another schematic diagram of the electrochemical processing system according to the first embodiment of the present invention;
[0006] FIG. 3 shows an exploded view of the electrochemical processing system according to the first embodiment of the present invention;
[0007] FIG. 4 shows a partially enlarged cross-sectional view of the electrochemical processing system according to the first embodiment of the present invention;
[0008] FIG. 5 shows a schematic diagram of the electrochemical processing system according to the second embodiment of the present invention;
[0009] FIG. 6 shows a schematic diagram of the workpiece having a mask layer according to an embodiment of the present invention; and
[0010] FIG. 7 shows a flowchart of the electrochemical processing method according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0011] In order to make the structure and characteristics as well as the effectiveness of the present invention to be further understood and recognized, the detailed description of the present invention is disclosed as follows along with embodiments and accompanying figures.

[0012] Please refer to FIG. 1 and FIG. 2, which show schematic diagram of the electrochemical processing system according to the first embodiment of the present invention in different viewing angles. As shown in the figures, the electrochemical processing system comprises an electrochemical processing apparatus and a clean module. The electrochemical processing apparatus comprises an electrode transport module and a belt electrode. The belt electrode is disposed at the electrode transport module; the clean module is corresponding to one side of the belt electrode. Thereby, the electrode transport module drives the belt electrode to move for performing the electrochemical process. In addition, a portion of the belt electrode passes through the clean module. The clean module may thereby clean this segment and remove the processing products or impurities attached to the surface of this segment. According to an embodiment of the present invention, the belt electrode is a ring belt electrode. The belt electrode according to the present invention is cyclic, and thus the electrochemical process may be performed continuously; the clean module may clean the segment of the belt electrode not undergoing the electrochemical process. Thereby, the surface of the belt electrode may be maintained clean.

[0013] Please refer to FIG. 3 and FIG. 4, which show an exploded view and a partially enlarged cross-sectional view of the electrochemical processing system according to the first embodiment of the present invention. As shown in the figures, according to the present embodiment, the electrochemical processing apparatus further comprises a carrier, which includes a base and a frame. The frame is disposed on the base. The base includes a processing region corresponding to the belt electrode. An electrical connecting part is disposed on the base. A belt workpiece is transported to the processing region of the base, corresponding to the belt electrode, and contacting the electrical connecting part.

[0014] In addition, a positioning module is disposed on the base and corresponding to the belt electrode. The positioning module includes two positioning members located on both sides of the processing region. The positioning module further comprises at least one electrolyte channel disposed at each positioning member. The electrolyte channel includes at least one inlet and at least one outlet. The inlet is disposed at the positioning member; the outlet is disposed on one side of the positioning member and corresponding to the processing region.

[0015] According to the present embodiment, the electrode transport module is disposed at the frame. The electrode transport module further comprises a rotating member and a driver, which is a first driver. According to an embodiment of the present invention, the driver is a motor; the rotating member may be a
wheel. The rotating member 111 is disposed corresponding to and against the inner side of the belt electrode 130. The driver 113 is connected with the rotating member 111 for driving the rotating member 111 to rotate. Moreover, the electrochemical processing apparatus 10 further comprises a conductive member 190 disposed corresponding to and against the inner side of the belt electrode 130. The conductive member 190 is located below the electrode transport module 110. In addition, the conductive member 190 includes a connecting part 191 and a fixing part 193. The connecting part is disposed at the bottom of the fixing part 193. The bottom surface of the connecting part 191 is against the inner side of the belt electrode 130. The bottom surface of the connecting part 191 includes a plane corresponding to the processing region 152, namely, corresponding to the belt workpiece 40. Besides, both side surfaces adjacent to the plane are curved surfaces. The connecting part 191 is located among the plurality of positioning members. Thereby, the positioning module 170 may position the belt electrode 130. The fixing part 193 is disposed at the plurality of positioning members 171 for fixing the conductive member 190.

[0016] According to the above description, the rotating member 111 and the conductive member 190 are against the upper and lower inner sides of the belt electrode 130, respectively. The belt electrode 130 may surround the curved surface of the rotating member 111, the plane of the connecting part 191 of the conductive member 190, and the two side curved surfaces. In addition, the conductive member 190 is located among the plurality of positioning members 171. A segment of the belt electrode 130 corresponds to the belt workpiece 40 in the processing region 152 and is spaced from the belt workpiece 40 by a gap.

[0017] Furthermore, a power supply module (not shown in the figures) supplies power. The anode and cathode thereof are coupled to the electrical connecting part 155 and the conductive member 190, respectively, for supply power to the belt workpiece 40 and the belt electrode 130. The belt workpiece 40 acts as the anode whereas the belt electrode 130 acts as the cathode for performing electrochemical processes. Besides, two insulating members 175 are disposed at the contacts between the fixing part 193 of the conductive member 190 and the plurality of positioning members 171 for avoiding short circuit.

[0018] According to the present embodiment, the clean module 30 is disposed at the frame 153 located on one side of the electrode transport module 110. The clean module 30 includes a wheel brush 310 and a driver 320. The driver 320 is a second driver. The wheel brush 310 is disposed corresponding to the outer side of the belt electrode 130 and contacts the outer surface of the belt electrode 130. The driver 320 is connected with the wheel brush 310 and drives the wheel brush 310 to rotate. When the wheel brush 310 rotates, it contacts the outer surface of the belt electrode 130 incessantly and thus cleaning the surface of the belt electrode 130.

[0019] According to the present embodiment, while performing an electrochemical process, the belt workpiece 40 is disposed in the processing region 152 of the base 151 and located among the plurality of positioning members 171. The belt electrode 130 and the belt workpiece 40 are spaced by a gap. The electrolyte is transported to the electrolyte channel 172, such that the electrolyte is located between the belt workpiece 40 and the belt electrode 130 and contacts the outer surface of the belt workpiece 40 and the belt electrode 130. The power supply module supplies power to the belt workpiece 40 and the belt electrode 130 for performing the electrochemical process. After performing the electrochemical process for a while, products are attached to the outer surface of the processing surface of the belt electrode 130 corresponding to the belt workpiece 40. The electrode transport module 110 drives the belt electrode 130 to move and remove the electrochemically processed segment of the belt electrode 130 out of the processing region 152. The removed segment will then undergo no electrochemical process. The unprocessed segment (the cleaned segment) of the belt electrode 130 is moved above the processing region 152 for process in succession. During the process of moving the belt electrode 130, the driver 320 drives the wheel brush 310 to rotate. The wheel brush 310 contacts the outer surface the currently unprocessed segment of the belt electrode 130 for removing mechanically the products or impurities attached on the outer surface of the belt electrode 130. Then the outer surface of the belt electrode 130 may be cleaned and ready for subsequent electrochemical process. Accordingly, the quality of electrochemical processes will not be affected.

[0020] According to the present embodiment, the belt electrode 130 may be roughly classified into an electrochemically processed segment and an electrochemically unprocessed (cleared) segment. While performing an electrochemical process, the electrochemically unprocessed segment (the clean segment) is moved into the processing region 152 and used as the electrode for the electrochemical process. The electrochemically processed segment is removed from the processing region 152. Meanwhile, the clean module 30 cleans the electrochemically processed segment of the belt electrode 130. Thus, the belt electrode 130 may be kept clean and continuous electrochemical processes may be performed. According to the above description, because the clean module 30 is able to clean the belt electrode 130 incessantly during electrochemical processes, the electrochemical processes need not to be stopped. Consequently, the process and time for cleaning may be saved and the electrochemical processing efficiency may be improved.

[0021] Please refer to FIG. 5 and FIG. 6, which show schematic diagrams of the electrochemical processing system and the workpiece having a mask layer according to the second embodiment of the present invention. As shown in the figures, the present embodiment further comprises a workpiece transport device 50, which includes two workpiece transport modules 510 located in front of and behind the electrochemical apparatus 10, respectively, for transporting the workpiece 40. In addition, the present embodiment further comprises a cover disposing device 60 and a cover removing device 61. The cover disposing device 60 is located in front of the electrochemical processing apparatus 10; the cover removing device 61 is located behind the electrochemical processing apparatus 10. The cover disposing device 60 is used for disposing a mask layer 610 on the belt workpiece 40. The mask layer 610 includes a plurality of hollow-out parts 600 for exposing the surface of the belt workpiece 40. The pattern of the hollow-out parts 600 corresponds to the pattern to be formed on the belt workpiece 40. The cover disposing device 60 disposes the mask layer 610 on the belt workpiece 40 using, but not limited to, the printing or exposure-development method. Other methods capable of disposing the mask layer 610 may be adopted.
as well. The cover removing device 61 is used for removing the mask layer 610 of the electrochemically processed belt workpiece 40.

[0022] Please refer to FIG. 7, which shows a flowchart of the electrochemical processing method according to an embodiment of the present invention. As shown in the figure, the electrochemical processing method according to the present invention comprises the following steps. In the step S1, dispose the mask layer 610 on the belt workpiece 40. Then, in the step S3, electrochemically process the belt workpiece 40 using the belt electrode 130. Next, in the step S5, move the belt electrode 130 and clean the surface of the belt electrode 130 mechanically for removing the attachments on the surface of the belt electrode 130. Afterwards, in the step S7, remove the mask layer 610 of the belt workpiece 40. In addition, while moving the belt electrode 130 in the step S5, clean the electrochemically unprocessed segment of the belt electrode 130 concurrently. The above steps S1 and S5 are not necessary steps. Alternatively, it is not necessary to dispose the mask layer 610 on the belt workpiece 40.

[0023] To sum up, the electrochemical processing system and method provided by the present invention enable the belt electrode to be moved and cleaned during an electrochemical process. It is not necessary to disassemble the belt electrode, nor should the electrochemical process be stopped. Thereby, the process and time for maintaining the electrode may be reduced and the electrochemical processing efficiency may be improved.

[0024] Accordingly, the present invention conforms to the legal requirements owing to its novelty, nonobviousness, and utility. However, the foregoing description is only embodiments of the present invention, not used to limit the scope and range of the present invention. Those equivalent changes or modifications made according to the shape, structure, feature, or spirit described in the claims of the present invention are included in the appended claims of the present invention.

What is claimed is:
1. An electrochemical processing system, comprising:
an electrochemical processing apparatus, comprising:
a belt electrode, disposed at said electrode transporting module; and
a clean module, corresponding to one side of said belt electrode.
2. The electrochemical processing system of claim 1, wherein said belt electrode is a ring belt electrode.
3. The electrochemical processing system of claim 1, wherein said electrode transporting module includes:
a rotating member, corresponding to and against the inner side of said belt electrode; and
a driver, connected with said rotating member for driving said rotating member to rotate.
4. The electrochemical processing system of claim 1, wherein said clean module includes:
a wheel brush, corresponding to one side of said belt electrode; and
a driver, connected with said wheel brush for driving said wheel brush to rotate.
5. The electrochemical processing system of claim 1, further comprising a conductive member corresponding to and against the inner side of said belt electrode.
6. The electrochemical processing system of claim 1, further comprising:
a positioning module, corresponding to said belt electrode; and
an electrolyte channel, disposed at said positioning module.
7. The electrochemical processing system of claim 1, further comprising:
a mask disposing device, located in front of said electrochemical processing apparatus; and
a mask removing device, located behind said electrochemical processing apparatus.

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