

# US Patent & Trademark Office

## Patent Public Search | Text View

---

United States Patent	12394627
Kind Code	B2
Date of Patent	August 19, 2025
Inventor(s)	Chae; Hee Sung et al.

---

### Substrate polishing system

---

#### Abstract

A substrate polishing system may include a substrate transfer unit comprising a shaft to rotate on a rotation axis perpendicular to a ground and at least one transfer arm to support a bottom surface of a substrate and transfer the substrate while forming a transfer orbit by rotation of the shaft, and at least one carrier to perform polishing the substrate transferred by the substrate transfer unit.

---

**Inventors:** Chae; Hee Sung (Gyeonggi-do, KR), Lee; Seung Eun (Seoul, KR), Yun; Geun Sik (Gyeonggi-do, KR)

**Applicant:** KCTECH CO., LTD. (Gyeonggi-do, KR)

**Family ID:** 1000008767633

**Assignee:** KCTech Co., Ltd. (Anseong-si, KR)

**Appl. No.:** 17/575913

**Filed:** January 14, 2022

#### Prior Publication Data

<b>Document Identifier</b>	<b>Publication Date</b>
US 20220277963 A1	Sep. 01, 2022

#### Foreign Application Priority Data

KR	10-2021-0026892	Feb. 26, 2021
----	-----------------	---------------

---

#### Publication Classification

**Int. Cl.:** H01L21/306 (20060101); H01L21/67 (20060101); H01L21/673 (20060101);  
H01L21/677 (20060101); H01L21/687 (20060101)

**U.S. Cl.:**

CPC     **H01L21/30625** (20130101); **H01L21/67219** (20130101); **H01L21/6732** (20130101);  
**H01L21/67766** (20130101); **H01L21/68764** (20130101); **H01L21/68792** (20130101);

## Field of Classification Search

**CPC:**     H01L (21/30625); H01L (21/67219); H01L (21/6732); H01L (21/67766); H01L  
(21/68764); H01L (21/68792); H01L (21/67092); H01L (21/67742); H01L (21/67745);  
B24B (37/30); B24B (37/345); B24B (37/10); B24B (27/0076)

---

## References Cited

### U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
5655954	12/1996	Oishi	451/287	H01L 21/67028
6358128	12/2001	Sakurai	451/287	B24B 37/345
6629883	12/2002	Katsuoka	451/41	H01L 21/67745
9054146	12/2014	Wi	N/A	H01L 21/68707
2004/0216842	12/2003	Jeong	156/345.11	B24B 37/042
2005/0111936	12/2004	Kim	414/217	H01L 21/67745
2005/0282472	12/2004	Jeong	N/A	N/A
2011/0104997	12/2010	Jeong	451/65	H01L 21/67219
2015/0105005	12/2014	Zuniga	451/259	B24B 37/10
2021/0323118	12/2020	Rangarajan	N/A	H01L 21/67219

### FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
2000124290	12/1999	JP	N/A
2002510875	12/2001	JP	N/A
2005131772	12/2004	JP	N/A

---

*Primary Examiner:* Allen; Joshua L

*Assistant Examiner:* Remavege; Christopher

*Attorney, Agent or Firm:* KDW Firm PLLC

---

## Background/Summary

### CROSS-REFERENCE TO RELATED APPLICATION

(1) This application claims the benefit of Korean Patent Application No. 10-2021-0026892 filed on Feb. 26, 2021, in the Korean Intellectual Property Office, the entire disclosure of which is incorporated herein by reference for all purposes.

### BACKGROUND

1. Field of the Invention

(2) One or more example embodiments relate to a substrate polishing system.

2. Description of the Related Art

(3) In the process of manufacturing a semiconductor device, a chemical mechanical polishing or planarization (CMP) process including polishing, buffing, and cleaning is required. The

semiconductor device may be configured to have a multilayer structure wherein a transistor device with a diffusion region is provided at a substrate layer. In the substrate layer, a connecting metallic line may be patterned and electrically connected to the transistor device that constitutes a functional device. A patterned conductive layer may be insulated from other conductive layers by an insulator such as silicon dioxide. As more metal layers and corresponding insulating layers are formed, a need to flatten insulators may increase. Without flattening, manufacturing an additional metal layer may be more difficult due to numerous irregularities in a surface. In addition, the metallic line pattern may be formed of an insulator and a metal CMP process may be performed to remove excess metal.

(4) To increase the production efficiency of the CMP process, reducing a waiting time between processes or transfers and performing the processes or transfers in parallel are required. For example, a production efficiency of the CMP process may be improved by reducing a substrate transfer path and simultaneously performing transferring and polishing on a plurality of substrates.

(5) The above description is information the inventor(s) acquired during the course of conceiving the present disclosure, or already possessed at the time, and is not necessarily art publicly known before the present application was filed.

#### SUMMARY

(6) Example embodiments provide a substrate polishing system that may simultaneously perform transferring and polishing on a plurality of substrates in parallel.

(7) Example embodiments also provide a substrate polishing system that may reduce a substrate transfer path and enhance a transfer efficiency.

(8) According to an aspect, there is provided a substrate polishing system including a substrate transfer unit may include a shaft to rotate on a rotation axis perpendicular to a ground and at least one transfer arm to support a bottom surface of a substrate, and transfer the substrate while forming a transfer orbit by rotation of the shaft, and at least one carrier to perform polishing the substrate transferred by the substrate transfer unit.

(9) The transfer arm may receive an unpolished substrate at a first transfer point on the transfer orbit and transfer the unpolished substrate to the carrier at a second transfer point on the transfer orbit.

(10) The transfer arm may receive a polished substrate from the carrier at the second transfer point and transfer the polished substrate to a next process at the first transfer point.

(11) The substrate polishing system may further include a loader disposed at the second transfer point wherein the loader loads the substrate from the transfer arm to the carrier or unloads the substrate from the carrier to the transfer arm.

(12) In a process of loading or unloading by the loader, the substrate transfer unit may be vertically movable.

(13) The loader may be integrally formed with the substrate transfer unit.

(14) A plurality of transfer arms may be provided and be each disposed at a predetermined interval with the shaft as center.

(15) When one of the plurality of transfer arms is placed on the first transfer point, at least one of the plurality of transfer arms may be placed on the second transfer point.

(16) The substrate polishing system may further include a carrier transfer unit to support the carrier from an upper side and transfer the carrier while forming a carrier orbit in a circle by rotating on a rotation axis perpendicular to a ground.

(17) The carrier may receive an unpolished substrate from the transfer arm at a first carrier point on the carrier orbit and perform polishing on the unpolished substrate at a second carrier point on the carrier orbit.

(18) The carrier may transfer a polished substrate from the first carrier point to the transfer arm placed on the second transfer point.

(19) The first carrier point may overlap with the second transfer point.

- (20) The second carrier point may overlap with a platen on which a polishing pad is placed.
- (21) A plurality of carriers may be provided and be each disposed at a predetermined interval with the rotation axis of the carrier transfer unit as a center.
- (22) When one of the plurality of carriers is placed on the first carrier point, at least one of the plurality of carriers may be placed on the second carrier point.
- (23) Additional aspects of example embodiments will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the disclosure.
- (24) According to example embodiments, a substrate polishing system may perform polishing on a plurality of substrates, in succession and in parallel, thereby improving production efficiency.
- (25) According to example embodiments, a substrate polishing system may perform loading and/or unloading of a second substrate while polishing a first substrate, thereby improving production efficiency.
- (26) According to example embodiments, a substrate polishing system may reduce a substrate transfer path and increase transfer efficiency.
- (27) The effects of the substrate polishing system are not limited to the above-mentioned effects, and other unmentioned effects can be clearly understood from the above description by those having ordinary skill in the technical field to which the present disclosure pertains.
- 

## **Description**

### **BRIEF DESCRIPTION OF THE DRAWINGS**

- (1) These and/or other aspects, features, and advantages of the invention will become apparent and more readily appreciated from the following description of example embodiments, taken in conjunction with the accompanying drawings of which:
- (2) FIG. 1 is a schematic perspective view of a substrate polishing system according to an example embodiment;
- (3) FIG. 2 is a schematic plan view of a substrate polishing system according to an example embodiment;
- (4) FIG. 3 is a schematic side view of a substrate polishing system according to an example embodiment;
- (5) FIG. 4 is a schematic plan view of a substrate polishing system according to an example embodiment; and
- (6) FIG. 5 is a schematic plan view of a substrate polishing system according to an example embodiment.

### **DETAILED DESCRIPTION**

- (7) Hereinafter, example embodiments will be described in detail with reference to the accompanying drawings. However, various alterations and modifications may be made to the example embodiments. Here, the example embodiments are not construed as limited to the disclosure. The example embodiments should be understood to include all changes, equivalents, and replacements within the idea and the technical scope of the disclosure.
- (8) The terminology used herein is for the purpose of describing particular example embodiments only and is not to be limiting of the example embodiments. The singular forms “a”, “an”, and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises/comprising” and/or “includes/including” when used herein, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components and/or groups thereof.
- (9) Unless otherwise defined, all terms including technical and scientific terms used herein have the

same meaning as commonly understood by one of ordinary skill in the art to which example embodiments belong. It will be further understood that terms, such as those defined in commonly-used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

(10) When describing the example embodiments with reference to the accompanying drawings, like reference numerals refer to like constituent elements and a repeated description related thereto will be omitted. In the description of example embodiments, detailed description of well-known related structures or functions will be omitted when it is deemed that such description will cause ambiguous interpretation of the present disclosure.

(11) Also, in the description of the components, terms such as first, second, A, B, (a), (b) or the like may be used herein when describing components of the present disclosure. These terms are used only for the purpose of discriminating one constituent element from another constituent element, and the nature, the sequences, or the orders of the constituent elements are not limited by the terms. When one constituent element is described as being “connected”, “coupled”, or “attached” to another constituent element, it should be understood that one constituent element can be connected or attached directly to another constituent element, and an intervening constituent element can also be “connected”, “coupled”, or “attached” to the constituent elements.

(12) The same name may be used to describe an element included in the example embodiments described above and an element having a common function. Unless otherwise mentioned, the descriptions on the example embodiments may be applicable to the following example embodiments and thus, duplicated descriptions will be omitted for conciseness.

(13) FIG. 1 is a schematic perspective view of a substrate polishing system according to an example embodiment. FIG. 2 is a schematic plan view of a substrate polishing system according to an example embodiment and FIG. 3 is a schematic side view of a substrate polishing system according to an example embodiment.

(14) Referring to FIGS. 1 to 3, a substrate polishing system 1 may be used in a chemical mechanical polishing or planarization (CMP) process to polish a surface of a substrate. A substrate polished by the substrate polishing system 1 may be a silicon wafer for manufacturing a semiconductor device. However, the type of the substrate is not limited to the foregoing example. The substrate may include, for example, glass for a liquid crystal display (LCD), a plasma display panel (PDP), and a flat panel display (FPD). Although the drawings illustrate a substrate in a circular form, the example is only for ease of description and the form of the substrate is not limited to the one illustrated in the drawings.

(15) The substrate polishing system 1 may include a substrate transfer unit 11, a loader 12, a carrier 13, a carrier transfer unit 14, and a platen 15.

(16) The substrate transfer unit 11 may receive an unpolished substrate from a cassette (or a process prior to polishing) through a return unit. The substrate transfer unit 11 may transfer the received substrate to the carrier 13. In addition, the substrate transfer unit 11 may receive a polished substrate from the carrier 13 and may transfer the polished substrate for a process performed after polishing (for example, a cleaning process). The substrate transfer unit 11 may transfer a substrate along a circular orbit. The substrate transfer unit 11 may simultaneously transfer a plurality of substrates. For example, a transfer of an unpolished substrate and a transfer of a polished substrate may be performed simultaneously.

(17) The substrate transfer unit 11 may include a shaft 111 and a transfer arm 112.

(18) The shaft 111 may rotate on a rotation axis perpendicular to a ground. The shaft 111 may rotate in one direction or in two directions. The transfer arm 112 may be connected to the shaft 111 and may integrally rotate with the shaft 111. The transfer arm 112 may support a bottom surface of a substrate. For example, one end of the transfer arm 112 may be connected to the shaft 111, and another end may support a bottom surface of a substrate. However, the transfer arm 112 of FIG. 1 is

schematically illustrated and a structure that may stably support a substrate may be provided at another end of the transfer arm **112**.

(19) The transfer arm **112** may rotate on the shaft **111** while forming a transfer orbit TO by rotation of the shaft **111**. The transfer orbit TO may be circular. The transfer arm **112** may transfer a substrate to one point on the transfer orbit TO by rotating on the shaft **111** while the substrate is placed on an end portion.

(20) At least one transfer arm **112** may be provided. For example, a plurality of transfer arms **112** may be provided. For example, the transfer arms **112** may include a first transfer arm **112a**, a second transfer arm **112b**, and a third transfer arm **112c**. The plurality of transfer arms **112** may each be disposed at a predetermined interval with the shaft **111** as a center. For example, the plurality of transfer arms **112** may each be disposed at an equiangular interval with the shaft **111** as a center. However, the number of transfer arms **112** of FIGS. **1** and **2** is an example, and there may be one, two, three, four, or more transfer arms **112**. A more detailed description of a transfer of a substrate by the transfer arms **112** is described below.

(21) The loader **12** may load an unpolished substrate from the transfer arm **112** to the carrier **13**. The loader **12** may unload a polished substrate from the carrier **13** to the transfer arm **112**. The loader **12** may load or unload a substrate through moving vertically. In a process of loading or unloading a substrate by the loader **12**, the substrate transfer unit **11** (for example, the transfer arm **112**) may be moved in a vertical direction. A plurality of loaders **12** may be provided. For example, a number of loaders **12** may correspond to a number of platens **15**. For example, as shown in FIGS. **1** and **2**, when the platen **15** includes a first platen **15a** and a second platen **15b**, the loader **12** may include a first loader **12a** and a second loader **12b**. Meanwhile, the loader **12** may be integrally formed with the substrate transfer unit **11**. That is, the substrate transfer unit **11** (for example, the transfer arm **112**) may load or unload a substrate onto the carrier **13** by itself through moving vertically without a loader.

(22) The carrier **13** may grip a substrate and may perform polishing on the substrate through rotation. The carrier **13** may grip a substrate from an upper side. For example, the carrier **13** may grip a substrate by adsorption through a membrane (not shown). A polishing pad (not shown) may be seated on an upper surface of the platen **15** and the platen **15** may rotate the polishing pad. The carrier **13** may perform polishing by placing the polishing pad placed on the platen **15** in frictional contact with a polishing surface of the substrate. The carrier **13** and the platen **15** may polish the substrate by the polishing pad through at least a relative rotational motion. For example, the carrier **13** may rotate and/or translate (oscillate) for polishing a substrate. Meanwhile, the carrier **13** may move in a vertical direction for loading/unloading a substrate or polishing the substrate.

(23) At least one carrier **13** may be provided for one platen **15**. In addition, at least one platen **15** may be provided. For example, as shown in FIGS. **1** and **2**, the carrier **13** may include a first carrier **13a**, a second carrier **13b**, a third carrier **13c**, and a fourth carrier **13d** and the platen **15** may include a first platen **15a** and a second platen **15b**. For example, as shown in FIGS. **1** and **2**, the first carrier **13a** and the second carrier **13b** may operate as a set for the first platen **15a**, and the third carrier **13c** and the fourth carrier **13d** may operate as a set for the second platen **15b**. However, FIGS. **1** and **2** show examples and there may be any number of platens **15** and any number of carriers **13**. In addition, any number of a plurality of carriers **13** may operate in a set for one platen **15**.

(24) The carrier transfer unit **14** may support the carrier **13** from an upper side and may move the carrier **13**. For example, the carrier transfer unit **14** form a carrier orbit CO while rotating on an axis perpendicular to the ground and may move the carrier **13**. The carrier orbit CO may be circular. A plurality of carrier transfer units **14** may be provided. For example, a number of the carrier transfer units **14** may correspond to a number of the platens **15**. For example, the carrier transfer unit **14** may include a first carrier transfer unit **14a** and a second carrier transfer unit **14b**. A plurality of carriers **13** may be connected to one carrier transfer unit **14**. For example, the first carrier transfer unit **14a** may be connected to the first carrier **13a** and the second carrier **13b**, and

the first carrier **13a** and the second carrier **13b** may move along a first carrier orbit CO1. The second carrier transfer unit **14b** may be connected to the third carrier **13c** and the fourth carrier **13d** and the third carrier **13c** and the fourth carrier **13d** may move along a second carrier orbit CO2. However, a number of carriers **13** connected to one carrier transfer unit **14** is not limited to the foregoing examples. When a plurality of carriers **13** is connected to one carrier transfer unit **14**, the plurality of carriers **13** may each be disposed at a predetermined interval with a rotation axis of the carrier transfer unit **14** as a center. For example, the plurality of carriers **13** may each be disposed at an equiangular interval with a rotation axis of the carrier transfer unit **14** as a center.

(25) Hereinafter, the transfer orbit TO of the substrate transfer unit **11** is described with reference to FIGS. 1 and 2.

(26) The transfer arm **112** may rotate along the transfer orbit TO and may be placed on at least one of a first transfer point TP1, a second transfer point TP2, and a third transfer point TP3.

(27) The transfer arm **112** may receive an unpolished substrate at the first transfer point TP1 on the transfer orbit TO. For example, the transfer arm **112** may receive an unpolished substrate from a cassette (or after a process prior to polishing) through a return unit (not shown). The received substrate may be seated on the transfer arm **112** placed on the first transfer point TP1. In addition, the transfer arm **112** may transfer a polished substrate at the first transfer point TP1 for a next process. For example, the transfer arm **112** may transfer a polished substrate for a next process (for example, a cleaning process) through the return unit at the first transfer point TP1. That is, the first transfer point TP1 may function as a stage on which a substrate waiting for transfer is seated.

(28) The transfer arm **112** may transfer an unpolished substrate to the carrier **13** at the second transfer point TP2 on the transfer orbit TO. In addition, the carrier **13** (for example, the first carrier **13a** or the second carrier **13b**) may receive an unpolished substrate from the transfer arm **112** at the first carrier point CP1 on the first carrier orbit CO1. That is, the second transfer point TP2 and the first carrier point CP1 may overlap with each other. The first loader **12a** may perform a transfer of a substrate between the transfer arm **112** and the carrier **13**. The first loader **12a** may be placed on the second transfer point TP2. The first loader **12a** may load an unpolished substrate from the transfer arm **112** placed on the second transfer point TP2 to the carrier **13** placed on the first carrier point CP1. The first loader **12a** may unload a polished substrate from the carrier **13** placed on the first carrier point CP1 to the transfer arm **112** placed on the second transfer point TP2.

(29) Similarly, the transfer arm **112** may transfer an unpolished substrate to the carrier **13** at the third transfer point TP3 on the transfer orbit TO. In addition, the carrier **13** (for example, the third carrier **13c** or the fourth carrier **13d**) may receive an unpolished substrate from the transfer arm **112** at the third carrier point CP3 on the second carrier orbit CO2. That is, the third transfer point TP3 and the third carrier point CP3 may overlap with each other. The second loader **12b** may perform a transfer of a substrate between the transfer arm **112** and the carrier **13**. The second loader **12b** may be placed on the third transfer point TP3. The second loader **12b** may load an unpolished substrate to the carrier **13** placed on the third carrier point CP3 from the transfer arm **112** placed on the third transfer point TP3. The second loader **12b** may unload a polished substrate from the carrier **13** placed on the third carrier point CP3 to the transfer arm **112** placed on the third transfer point TP3.

(30) When one of the plurality of transfer arms **112** is placed on the first transfer point TP1, at least another one of the plurality of transfer arms **112** may be placed on the second transfer point TP2. For example, when the first transfer arm **112a** is placed on the first transfer point TP1, the second transfer arm **112b** may be placed on the second transfer point TP2. Referring to FIGS. 1 and 2, when the first transfer arm **112a** is placed on the first transfer point TP1, the second transfer arm **112b** may be placed on the second transfer point TP2, and the third transfer arm **112c** may be placed on the third transfer point TP3. By rotation of the shaft **111**, the transfer arms **112a**, **112b**, and **112c** may be sequentially placed on the transfer points TP1, TP2, and TP3 respectively.

(31) However, a position and a moving order of the transfer arm **112** are not limited to the foregoing examples. For example, the transfer arm **112** may be transferred from the first transfer

point TP1 to the second transfer point TP2, may be directly transferred from the first transfer point TP1 to the third transfer point TP3 passing by the second transfer point TP2, and may be transferred from the first transfer point TP1 to the third transfer point TP3 by rotating in reverse. In addition, the transfer arm 112 may be placed on various points such as a point between the first transfer point TP1 and the second transfer point TP2.

(32) Hereinafter, the carrier orbit CO of the carrier 13 is described with reference to FIGS. 1 and 2. The following description refers to the first carrier 13a, the second carrier 13b, the first carrier transfer unit 14a and the first platen 15a. A description of the third carrier 13c, the fourth carrier 13d, the second carrier transfer unit 14b and the second platen 15b would be substantially the same as the following description. Thus, only the following description is used, to avoid excessive repetition.

(33) The first carrier 13a and the second carrier 13b may be rotated along the first carrier orbit CO1 by rotation of the first carrier transfer unit 14a and may be placed on the first carrier point CP1 and the second carrier point CP2 sequentially. For example, when one of the plurality of carriers 13 is placed on the first carrier point CP1, another one of the plurality of carriers 13 may be placed on the second carrier point CP2. For example, when the first carrier 13a is placed on the first carrier point CP1, the second carrier 13b may be placed on the second carrier point CP2.

(34) The first carrier 13a or the second carrier 13b may receive (load) an unpolished substrate from the substrate transfer unit 11 at the first carrier point CP1 on the first carrier orbit CO1. When the substrate is loaded, the first carrier 13a or the second carrier 13b may move to the second carrier point CP2 on the first carrier orbit CO1 by rotation of the first carrier transfer unit 14a. The first carrier 13a or the second carrier 13b may perform polishing on the unpolished substrate at the second carrier point CP2 on the first carrier orbit CO1. That is, the second carrier point CP2 may overlap with the first platen 15a. When the substrate is polished, the first carrier 13a or the second carrier 13b may move back to the first carrier point CP1 by rotation of the first carrier transfer unit 14a. The first carrier 13a or the second carrier 13b may transfer (unload) the polished substrate to the substrate transfer unit 11 from the first carrier point CP1.

(35) For example, primary polishing may be performed at the first platen 15a and secondary polishing may be performed at the second platen 15b. In this case, when a substrate on which the primary polishing is performed at the first platen 15a is unloaded from the first carrier point CP1 to the transfer arm 112 that is placed on the second transfer point TP2, the transfer arm 112 may be moved to the third transfer point TP3 by rotation of the shaft. The substrate on which the primary polishing is done may be loaded to the carrier 13 placed on the third carrier point CP3 from the third transfer point TP3, and the carrier 13 may be moved to the fourth carrier point CP4 by rotation of the second carrier transfer unit 14b and may perform secondary polishing.

(36) For example, a substrate transferred to the first transfer point TP1 may be transferred to the second transfer point TP2, and then, may be gripped by the carrier 13 placed on the first carrier point CP1, and may be polished by the first platen 15a at the second carrier point CP2. The substrate polished by the first platen 15a may be returned to the first carrier point CP1, may be seated on the transfer arm 112 placed on the second transfer point TP2, may be moved to the third transfer point TP3 and may be gripped by the carrier 13 placed on the third carrier point CP3, and may be polished by the second platen 15b at the fourth carrier point CP4. The substrate polished at the second platen 15b may be returned to the third carrier point CP3, may be seated on the transfer arm 112 placed on the third transfer point TP3, and may be moved to the first transfer point TP and may be transferred for a next process.

(37) As described above, when the carrier transfer unit 14 transfers a carrier and/or a substrate in a rotational way, transferring (for example, loading/unloading) and polishing a plurality of substrates may be performed simultaneously. For example, while a first substrate is loaded to the carrier 13 placed on the first carrier point CP1 from the second transfer point TP2, a second substrate may be gripped by the carrier 13 placed on the second carrier point CP2 and may be polished. In addition,



when the second substrate is polished, the second substrate may be moved to the first carrier point CP1 and may be unloaded to the transfer arm 112 placed on the second transfer point TP2, conversely, the first substrate may be moved to the second carrier point CP2 and may be polished. While polishing a substrate, loading (or unloading) another substrate may be simultaneously performed by way of the above-described configuration. Thus, process time may be reduced and productivity may be enhanced.

(38) In addition, as described above, when the substrate transfer unit 11 transfers a substrate by rotation, a transfer path and time for transferring may be minimized. For example, when the first substrate which is unpolished is inserted to the first transfer point TP1 from a cassette, the first substrate may be transferred to the second transfer point TP2 and may be loaded for the primary polishing. Simultaneously, the second substrate on which the primary polishing is being done wherein the second substrate is seated on the second transfer point TP2 may be transferred to the third transfer point TP3 and may be loaded for the secondary polishing. In addition, simultaneously, a third substrate on which the secondary polishing is being done wherein the third substrate is seated on the third transfer point TP3 may be transferred to the first transfer point TP1 and may be transferred for a next process. The above-mentioned process may be simultaneously, sequentially, and continuously performed on a plurality of substrates. Thus, a production efficiency may be enhanced since a plurality of substrates may be simultaneously and continuously transferred and polished.

(39) FIG. 4 is a schematic plan view illustrating a substrate polishing system according to an example embodiment.

(40) Referring to FIG. 4, a substrate polishing system 2 may include a substrate transfer unit 21, a loader 22, a carrier 23, a carrier transfer unit 24 and a platen 25.

(41) FIG. 4 illustrates a structure provided with the substrate transfer unit 21 including two transfer arms 212, two carriers 23, one carrier transfer unit 24, and one platen 25. Referring to the structure of FIG. 4, a description of a first transfer point TP1, a second transfer point TP2, a first carrier point CP1 and a second carrier point CP2 would be substantially same as the above description, thus, details thereof have been omitted.

(42) Even in the structure of FIG. 4, while a first substrate is undergoing polishing at the second carrier point CP2, a second substrate may be loaded or unloaded at the first carrier point CP1. In addition, by rotation of the substrate transfer unit 21, an unpolished substrate placed on the first transfer point TP1 may be transferred to the second transfer point TP2 while a polished substrate placed on the second transfer point TP2 may be transferred to the first transfer point TP1.

(43) FIG. 5 is a schematic plan view illustrating a substrate polishing system according to an example embodiment.

(44) Referring to FIG. 5, a substrate polishing system 3 may include a substrate transfer unit 31, a loader 32, a carrier 33, a carrier transfer unit 34 and a platen 35.

(45) FIG. 5 illustrates a structure provided with the substrate transfer unit 31 including four transfer arms 312, four carriers 33, two carrier transfer units 34, and two platens 35. In the structure of FIG. 5, four transfer arms 312 may be placed on a first transfer point TP1, a second transfer point TP2, a third transfer point TP3, and a fourth transfer point TP4 respectively. The fourth transfer point TP4 may be a point at which an unpolished substrate is received from a return unit or a polished substrate is transferred to the return unit. A description of the carrier 33, the carrier transfer unit 34 and the platen 35 would be substantially the same as the above description, thus, details thereof have been omitted.

(46) Even in the structure of FIG. 5, while a first substrate is undergoing polishing at the second carrier point CP2 (or the fourth carrier point CP4), a second substrate may be loaded or unloaded at the first carrier point CP1 (or the third carrier point CP3). In addition, substrates may be sequentially transferred by rotation of the substrate transfer unit 31. For example, an unpolished substrate placed on the first transfer point TP1 may be transferred to the second transfer point TP2

or the third transfer point TP3. Simultaneously, a polished substrate placed on the third transfer point TP3 or the second transfer point TP2 may be transferred to the fourth transfer point TP4.

(47) While this disclosure includes specific examples, it will be apparent to one of ordinary skill in the art that various changes in form and details may be made in these examples without departing from the spirit and scope of the claims and their equivalents. The examples described herein are to be considered in a descriptive sense only, and not for purposes of limitation. Descriptions of features or aspects in each example are to be considered as being applicable to similar features or aspects in other examples. For example, suitable results may be achieved if the described techniques are performed in a different order and/or if components in a described system, architecture, device, or circuit are combined in a different manner and/or replaced or supplemented by other components or their equivalents.

(48) Accordingly, other implementations are within the scope of the following claims.

## Claims

1. A substrate polishing system comprising: a substrate transfer unit comprising a shaft to rotate on a rotation axis perpendicular to a ground and at least one transfer arm to support a bottom surface of a substrate, and transfer the substrate while forming a transfer orbit by rotation of the shaft; at least one carrier to perform polishing of the substrate transferred by the substrate transfer unit; and a carrier transfer unit to support the at least one carrier from an upper side of the at least one carrier, the carrier transfer unit to rotate on a rotation axis perpendicular to a ground in a circular orbit moving the at least one carrier in a carrier orbit, to move the at least one carrier from the substrate transfer unit for a polishing process, wherein: the at least one transfer arm comprises a first end connected to the shaft and a second end, opposite the first end, configured to support the bottom surface of the substrate, and the carrier orbit is above and overlapping a portion of the transfer orbit.
2. The substrate polishing system of claim 1, wherein the transfer arm receives an unpolished substrate at a first transfer point on the transfer orbit and transfers the unpolished substrate to the carrier at a second transfer point on the transfer orbit.
3. The substrate polishing system of claim 2, wherein the transfer arm receives a polished substrate from the carrier at the second transfer point and transfers the polished substrate to the first transfer point for a next process.
4. The substrate polishing system of claim 2, further comprising: a loader disposed at the second transfer point wherein the loader loads the substrate from the transfer arm to the carrier or unloads the substrate from the carrier to the transfer arm.
5. The substrate polishing system of claim 4, wherein in a process of loading or unloading by the loader, the substrate transfer unit is vertically movable.
6. The substrate polishing system of claim 5, wherein the loader is integrally formed with the substrate transfer unit.
7. The substrate polishing system of claim 2, wherein a plurality of transfer arms is provided and are each disposed at a predetermined interval with the shaft as center.
8. The substrate polishing system of claim 7, wherein, when one of the plurality of transfer arms is placed on the first transfer point, at least one of the plurality of transfer arms is placed on the second transfer point.
9. The substrate polishing system of claim 1, wherein the carrier receives an unpolished substrate from the transfer arm at a first carrier point on the carrier orbit and performs polishing on the unpolished substrate at a second carrier point on the carrier orbit.
10. The substrate polishing system of claim 9, wherein the carrier transfers a polished substrate from the first carrier point to the transfer arm placed on the second transfer point.
11. The substrate polishing system of claim 10, wherein the first carrier point overlaps with the

second transfer point.

12. The substrate polishing system of claim 10, wherein a plurality of carriers is provided and are each disposed at a predetermined interval with the rotation axis of the carrier transfer unit as a center.

13. The substrate polishing system of claim 12, wherein, when one of the plurality of carriers is placed on the first carrier point, at least one of the plurality of carriers is placed on the second carrier point.

14. The substrate polishing system of claim 9, wherein the second carrier point overlaps with a platen on which a polishing pad is placed.

15. The substrate polishing system of claim 1, wherein the at least one carrier comprises a plurality of carriers, each of the plurality of carriers attached to the carrier transfer unit.

16. The substrate polishing system of claim 15, the plurality of carriers disposed at an equiangular interval with a rotation axis of the carrier transfer unit as a center.

17. The substrate polishing system of claim 15, wherein the carrier transfer unit rotates in the circular orbit to move one of the plurality of carriers from the substrate transfer unit to a platen for the polishing process and another of the plurality of carriers, carrying a polished substrate, from the platen back to the substrate transfer unit.

---