SMIF pods thereto. The input towering elevator may further comprise two tiers of racks for loading the SMIF pods thereon, the top rack is connected to the bridge conveyer.

[0011] In accordance with another embodiment, the downstream unit comprises an output carrier buffering unit for the plurality of processed SMIF pods thereon; and an output towering elevator disposed over the output loader, the output towering elevator comprises racks for loading SMIF pods transported through the bridge conveyer, and handling means for picking up SMIF pods and loading the same onto the output loader for receiving the processed contents. The output towering elevator may further comprise two tiers of racks for loading the SMIF pods thereon, the top rack is connected to the bridge conveyer.

[0012] In yet a further embodiment, each of the towering elevator may comprise a handling arm slidably mounted on a sliding bar, wherein the sliding bar is adapted to slide vertically over height of the towering elevator.

[0013] In yet a further embodiment, the bridge conveyer comprises motorized wheels for conveying loaded pods.

[0014] In another embodiment, the upstream unit may comprise a RFID scanner for reading an RFID tag attached to each of the SMIF pod. The downstream unit may also comprise a RFID scanner for reading an RFID tag attached to each of the SMIF pod.

[0015] In a further embodiment, the bridge conveyer comprises a buffering and sorting rail, the buffering and sorting rail comprises two rolls of sorting lots extending along the length of the pod handler; and a shuttle movable along an aisle rail between

the two rolls of sorting lots, wherein the shuttle is adapted to operably load and unload SMIF pods over the two rolls of the sorting lots. Each of the sorting lots and shuttle may include a wheel conveyer oriented horizontally against the length of the buffering and sorting rail, wherein SMIF pod loaded thereon can be conveyed sideway between the two rolls of lots and the shuttle. The wheel conveyer may include individually motorized in-line wheels.

Brief Description of Drawings

[0016] **FIG. 1** illustrates a front perspective view of SMIF pod carrier system in accordance with an embodiment of the present invention;

[0017] **FIG. 2** illustrates a back perspective view of the SMIF pod carrier system of **FIG. 1**;

[0018] **FIG. 3** illustrates a closed up view of a picking means in accordance with an embodiment of the present invention;

[0019] **FIG. 4** illustrates a back perspective view of a SMIF pod handler in accordance with an embodiment of the present invention.

Detailed Description

[0020] Embodiments of the present invention shall now be described in detail, with reference to the attached drawings. It is to be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as

Depending on the space available, the input carrier buffering unit **122** allows a plurality of SMIF pods **101** be pre-loaded thereon for processing in, preferably, first in first out (FIFO) sequence.

[0023] Next to the end of the input carrier-buffering unit **122** is the SMIF pod loader **124**, whereby the contents, i.e. wafer cassette, in the SMIF pods **101** are being transferred automatically to the processing equipment. As mentioned before, current processing usually requires two pod loaders for handling two pods. The SMIF pod loader **124** is an equipment adapted for transferring the contents loaded within the SMIF pods to the processing equipment. It is also commonly known as pod loader interface (PLI). Such PLI can be a loading/reloading module built in to the wafer processing equipment, or it can be an interfacing add-ons adapted to work in conjunction with the wafer processing equipment. Typically, the PLI also include machinery, such as robot arms, that is adapted to transfer the contents into the processing equipment. Various designs and configurations are available in the market and it is well known in the art, therefore, no specific details is provided herein unless it is required for the purpose of this application. As illustrated in the present embodiment, the pod loaders **124** are not provided with the lifting arm to remove the cover because opening the cover is handled by the input towering elevator **126**, which will be described in more details later. In another embodiment, the pod loaders may be equipped with a pod cover lifter. Operationally, the SMIF pods **101** are loaded one by one the operator on the input carrier-buffering unit **122** will be conveyed to the other end, and whenever the input pod loaders **124** are vacant, the SMIF pods **101** are transported to the loader **124** for removing the contents therefrom. Once the contents in the SMIF pods **101** are removed, the emptied pods **101** are being lifted by the bridge conveyer **106**.

[0024] The input towering elevator **126** is configured as a high-rise frame **158** and it is adapted to lift the SMIF pods **101** onto the racks above the SMIF pod loader **124** for standing by. These racks are configured in at least two tiers **154** with a capacity to hold up a plurality of SMIF pods on each tier. Each rack too comprises guiding rail **152** having conveyer wheels for transporting the pods **101** along the guiding rail **152**. The guiding rails are adapted as holding areas or buffering area for standing by the pods for handling.

[0025] Still referring to **FIG. 2**, the input towering elevator **126** may provide suitable actuating arms or carrier frames for lifting and conveying the pods from one locations to another, depending on the configuration of the SMIF pod. In one illustrative example, the input towering elevator **126** comprises movable rail **156** that operably elevates up and down over the height of the frame **158** of the input towering elevator **126**. The movable rail further includes picking mean **159** movable along the width of the towering elevator (i.e. length of the movable rail **156**). That makes it capable to pick and place within any location framed within the tower's frame **158**. In the illustrated example, the picking means **159** comprises a pair of forks that is configured to engage with the SMIF pod **101**. In one embodiment, the pair of forks is moveable sideway away/toward each other. The pair of forks is guided to park on two sides of the SMIF pod, and once they move toward each other, it holds on to the cover of the SMIF pod **101**.

[0026] In one embodiment, each SMIF pod **101** is RFID (Radio Frequency Identity) tagged (not shown), whereby the SMIF handler **100** is also equipped with RFID scanner (not shown). In one alternative embodiment, the RFID scanner is located at the upstream unit **102**. More specifically, the RFID scanner may be positioned at the input

carrier-buffering unit **122** to scan the ID, and only validated and paired pods are loaded to the POD loader **124** for further processing. The SMIF pods that can't be validated or paired will be removed by the operator manually.

[0027] It is well understood that RFID tag is used to identifying the pods. Other identity tagging may also be adapted, for example, bar code or any 2D matrix code, or smart chip or smart tag or the like can also be adapted herewith.

[0028] With the above configurations, several SMIF pods can be loaded from the loading bay of the input carrier-buffering unit **122** one after another, and they are conveyed to the lifting end of the input carrier-buffering unit **122**. As the pods **101** passes through the rail **152** of the input carrier-buffering unit **122**, each pod is being scanned for identity. Pods that failed for validation, on the other hand will be removed by the operator manually. The pods that pass the validation and pairing (for twin pod processing equipment) will be conveyed to the other end of the input carrier buffering unit **122** to standby.

[0029] As the pods reach the end of the rail **152**, when the pod loaders are not occupied, the priority is given where the loaded pods **101** are being lifted by the picking means and transport to the input pod loaders **124**. Once they are loaded onto the input pod loader **124**, the pod cover is being opened to reveal the contents, i.e. the wafers and cassette, and the contents thereof are transferred to the processing equipment for further processing. After the contents are removed from the pods, the emptied pods are then lifted to the buffering areas.

deployed on the output buffering carrier unit **142**. The carriers ID can be displayed on a HMI monitor (not shown) for ease of unloading by the operator.

[0034] **FIG. 3** shows a close up view of a picking means of the carrier **100** in accordance with an embodiment of the present invention. The picking means **300** is installed on the input and output towering elevator **126**, **146**. The picking means **300** comprises a motorized horizontal slide assembly **302**, a motorized vertical slide assembly **304** and a pair of carrier arms **306**. Both the motorized horizontal slide assembly **302** and the vertical slide assembly **304** are disposed on a sliding bar attached across the inner width of the supporting frame of the towering elevator. The motorized horizontal slide assembly **302** is attached on the body length of the sliding bar **150**, wherein operationally, it is slidable along the length of the sliding bar **150** via the motorized assembly. The motorized vertical slide assembly **304** may be mounted on both ends of the sliding bar **150** to support the sliding bar **150** on the frame of the towering elevators, which allow the sliding bar **150** to move vertically along the height of the towering elevator. The carrier arm **306** is further supported on the motorized horizontal slide assembly **302** that allows the carrier arm **306** too movable along the body length of the sliding bar **150**. Such configuration allows the carrier arm **306** movable in any location within the frame of the towering elevator. Accordingly, it is able to load and unload the SMIF pods in any locations within the carrier system **100**.

[0035] In one embodiment of the present invention, the carrier arm **306** may be adapted as a fail-safe type mechanism to protect the equipment it handles. Desirably, it comprises extended arms projected to engage with the SMIF pod **101**.

CLAIMS

1. A SMIF pod handler for handling Standard Mechanical InterFace (SMIF) pods to be processed under a processing equipment, wherein the processing equipment having an input pod loader and an output pod loader for handling the contents in the SMIF pod, the SMIF pod handler comprising:

an upstream unit disposed over the input pod loader;

a downstream unit disposed over the output pod loader;

a bridge conveyer connecting the upstream unit and the downstream unit;

whereby operationally, a plurality of SMIF pods are loaded on the upstream unit, said upstream unit comprises input handling means adapted to load the SMIF pods on the input pod loader and transport the emptied SMIF pods to the bridge conveyer, the bridge conveyer automatically conveys the emptied SMIF pods to the downstream unit, said downstream unit comprises input handling means adapted to load the emptied SMIF pods onto the output pod loader for receiving the processed contents from the processing equipment.

2. The SMIF pod handler according to claim 1, wherein the upstream unit comprises:

an input carrier buffering unit for preloading the plurality of SMIF pods thereon,

an input towering elevator disposed over the input pod loader, the input towering elevator comprises handling means for picking up the SMIF pods from the input carrier buffering unit, racks for loading the SMIF pods thereto.

3. The SMIF pod handler according to claim 2, wherein the input towering elevator comprises two tiers of racks for loading the SMIF pods thereon, the top rack is connected to the bridge conveyer.

4. The SMIF pod handler according to claim 1, wherein the downstream unit comprises:

an output carrier buffering unit for the plurality of processed SMIF pods thereon,

an output towering elevator disposed over the output pod loader, the output towering elevator comprises racks for loading the SMIF pods transported through the bridge conveyer, and handling means for picking up the SMIF pods and loading the same onto the output loader for receiving the processed contents.

5. The SMIF pod handler according to claim 4, wherein the output towering elevator comprises two tiers of racks for loading the SMIF pods thereon, the top rack is connected to the bridge conveyer.

6. The SMIF pod handler according to claim 2 and claim 4, wherein each of the towering elevator comprises a handling arm slidably mounted on a sliding bar, wherein the sliding bar is adapted to slide vertically over height of the towering elevator.

7. The SMIF pod handler according to claim 1, wherein the bridge conveyer comprises motorized wheels for conveying the loaded SMIF pods.

8. The SMIF pod handler according to claim 1, wherein the upstream unit comprises a RFID scanner for reading an RFID tag attached to each of the SMIF pod.

9. The SMIF pod handler according to claim 1, wherein the downstream unit comprises a RFID scanner for reading an RFID tag attached to each of the SMIF pod.

10. The SMIF pod handler according to claim 1, wherein the bridge conveyer comprises a buffering and sorting rail, the buffering and sorting rail comprising:
two rolls of sorting lots extending along the length of the SMIF pod handler;
a shuttle movable along an aisle rail between the two rolls of sorting lots, wherein the shuttle is adapted to operably load and unload the SMIF pods over the two rolls of sorting lots.

11. The SMIF pod handler according to claim 10, wherein each of the sorting lots and shuttle comprises a wheel conveyer oriented horizontally against the length of the buffering and sorting rail, wherein the SMIF pod loaded thereon can be conveyed sideway between the two rolls of sorting lots and the shuttle.

5

12. The SMIF pod handler according to claim 11, wherein the wheel conveyer comprises individually motorized in-line wheels.