

Claims

1. A system to reduce particle contamination on substrates, the system comprising:
 - a substrate traverser mechanism having one or more tracks to transport substrate carriers;
 - one or more traverser ducts arranged to at least partially surround the one or more tracks, the one or more ducts having slits along at least a substantial portion of a length of the one or more tracks, the slits arranged above and below the one or more tracks; and
 - a traverser exhaust fan coupled to one end of each of the one or more traverser ducts, the traverser exhaust fan to provide sufficient volumetric airflow to provide a velocity of the volumetric airflow in a direction away from the substrate carriers on the one or more tracks through the slits greater than a terminal settling velocity of a predetermined particle size, the traverser exhaust fan further to draw particles less than about the predetermined particle size generated by the substrate traverser mechanism into the one or more traverser ducts.
2. The system of claim 1, wherein the one or more traverser ducts have a differing cross-sectional area along the length to balance a pressure drop from the traverser exhaust fan allowing a substantially uniform airflow velocity along a length of the slits.
3. The system of claim 1, wherein the terminal settling velocity is determined for the predetermined particle size being less than about 50 μm .
4. A system to reduce particle contamination on substrates, the system comprising:
 - a housing to couple a substrate production tool to a fan filter unit, the fan filter unit to provide filtered air to the housing;
 - a facility connection to couple the substrate production tool to a reduced pressure exhaust mechanism;
 - a substrate transfer section coupled below the housing and in airflow communication with the facility connection, the substrate transfer section partially containing a clock-arm substrate carrier mechanism having a plurality of carrier arms each having a midpoint and a respective drive between opposing ends and arranged to rotate about the midpoint in planes parallel to one another, the respective drive coupled to each of the plurality of carrier arms to move respective ones of the plurality of carrier arms in at least a 360 degree arc in either

direction simultaneously, the substrate transfer section further having a linear substrate traverser mechanism having a plurality of linear substrate carriers mounted thereon, each of the plurality of linear substrate carriers being configured to transport the substrates in a plane substantially parallel to the planes of the plurality of carrier arms with each of the plurality of linear substrate carriers being in a different plane from one another;

a substrate process area coupled to the substrate transfer section by one or more substrate transport slots, the clock-arm substrate carrier mechanism being arranged to transport the substrates between the substrate process area and the substrate transfer section via the one or more substrate transport slots; and

a chamber substantially containing the substrate transfer section and the substrate process area, the chamber being coupled to the housing to receive the filtered air and coupled to the facility connection to provide an exhaust for excess gas flow, the chamber being configured to maintain a low pressure in the substrate process area relative to the substrate transfer section.

5. The system of claim 4, further comprising at least one peripheral substrate transport slot positioned proximal to an outer periphery of a rotational path traversed by the plurality of carrier arms and to one end of the linear substrate traverser mechanism.

6. The system of claim 5, wherein the at least one peripheral substrate transport slot is configured to receive the substrates into and out from the chamber from a substrate enclosure, the at least one peripheral substrate transport slot to be maintained at a low pressure relative to the substrate enclosure.

7. The system of claim 4, wherein the linear substrate traverser mechanism is operationally coupled above the plurality of carrier arms.

8. The system of claim 4, wherein the linear substrate traverser mechanism further comprises:

at least two upper tracks;

at least two lower tracks; and

linear drive mechanisms respectively coupled to each of the at least two upper tracks and the two lower tracks, each of the plurality of linear substrate carriers mechanically coupled to a unique one of the linear drive mechanisms.

9. The system of claim 8, wherein the linear substrate traverser mechanism is positioned between the housing and the facility connection, a volume in which the linear substrate traverser mechanism operates is configured to be at a higher pressure than a pressure at the facility connection to draw particles generated by the linear drive mechanisms into the reduced pressure exhaust mechanism during operation.

10. The system of claim 4, wherein the one or more substrate transport slots are arranged to maintain the low pressure in the substrate process area relative to the substrate transfer section.

11. The system of claim 4, wherein the chamber is further configured to maintain a high pressure in the substrate transfer section relative to the facility connection.

12. The system of claim 4, wherein the chamber is further configured to maintain a high pressure in the substrate process area relative to the facility connection.

13. The system of claim 4, wherein the substrate transfer section and the substrate process area are located substantially horizontal relative to one another.

14. The system of claim 4, wherein the facility connection is located below the substrate transfer section.

15. The system of claim 4, wherein the chamber further includes a substrate port to receive the substrates into and out from the chamber from a substrate enclosure, the substrate port to be maintained at a low pressure relative to the substrate enclosure.

16. The system of claim 4, wherein the substrate process area includes a chemical process section.

17. The system of claim 16, wherein the chamber being configured to maintain a low pressure in the substrate process area relative to the substrate transfer section is to substantially contain chemical vapors within the chemical process section from reaching the substrate transfer section.

18. A system to reduce particle contamination on wafers in a wafer process tool, the system comprising:

- a fan filter unit to provide filtered air to the wafer process tool;

- a facility connection to couple the wafer process tool to a reduced pressure exhaust mechanism of a wafer fabrication facility;

- a wafer transfer section coupled below the fan filter unit and in airflow communication with the facility connection, the wafer transfer section partially containing a clock-arm wafer carrier mechanism having a plurality of carrier arms each having a midpoint and a respective drive between opposing ends and arranged to rotate about the midpoint in planes parallel to one another, the respective drive coupled to each of the plurality of carrier arms to move respective ones of the plurality of carrier arms in at least a 360 degree arc in either direction simultaneously, the wafer transfer section further having a linear wafer traverser mechanism having a plurality of linear wafer carriers mounted thereon, each of the plurality of linear wafer carriers being configured to transport the wafers in a plane substantially parallel to the planes of the plurality of carrier arms with each of the plurality of linear wafer carriers being in a different plane from one another;

- a wafer process area coupled to the wafer transfer section by one or more wafer transport slots, the clock-arm wafer carrier mechanism being arranged to transport the wafers between the wafer process area and the wafer transfer section via the one or more wafer transport slots; and

- a process chamber substantially containing the wafer transfer section and the wafer process area, the process chamber being coupled to the fan filter unit to receive the filtered air and coupled to the facility connection to provide an exhaust for excess gas flow, the process chamber being configured to maintain a low pressure in the wafer process area relative to the wafer transfer section.

19. The system of claim 18, wherein the wafer process area includes a chemical process section.

20. The system of claim 19, wherein the process chamber being configured to maintain a low pressure in the wafer process area relative to the wafer transfer section is to substantially contain chemical vapors within the chemical process section from reaching the wafer transfer section.
21. The system of claim 18, wherein the one or more wafer transport slots are arranged to maintain the low pressure in the wafer process area relative to the wafer transfer section.
22. The system of claim 18, wherein the process chamber is further configured to maintain a high pressure in the wafer transfer section relative to the facility connection.
23. The system of claim 18, wherein the process chamber is further configured to maintain a high pressure in the wafer process area relative to the facility connection.
24. The system of claim 18, wherein the wafer transfer section and the wafer process area are located substantially horizontal relative to one another.
25. The system of claim 18, wherein the facility connection is located below the wafer transfer section.
26. The system of claim 18, further comprising at least one peripheral wafer transport slot positioned proximal to an outer periphery of a rotational path traversed by the plurality of carrier arms and to one end of the linear wafer traverser mechanism.
27. The system of claim 26, wherein the at least one peripheral wafer transport slot is configured to receive the wafers into and out from the chamber from a wafer enclosure, the at least one peripheral wafer transport slot to be maintained at a low pressure relative to the wafer enclosure.
28. The system of claim 18, wherein the linear wafer traverser mechanism is operationally coupled above the plurality of carrier arms.

29. The system of claim 18, wherein the linear wafer traverser mechanism further comprises:

at least two upper tracks;

at least two lower tracks; and

linear drive mechanisms respectively coupled to each of the at least two upper tracks and the two lower tracks, each of the plurality of linear wafer carriers mechanically coupled to a unique one of the linear drive mechanisms.

30. The system of claim 29, wherein the linear wafer traverser mechanism is positioned between the fan filter unit and the facility connection, a volume in which the linear wafer traverser mechanism operates is configured to be at a higher pressure than a pressure at the facility connection to draw particles generated by the linear drive mechanisms into the reduced pressure exhaust mechanism during operation.

31. A method of reducing particle contamination on substrates, the method comprising:

providing a housing to couple a substrate production tool to a fan filter unit, the fan filter unit providing filtered air to the substrate production tool;

providing a facility connection to couple the substrate production tool to a reduced pressure exhaust mechanism, the reduced pressure exhaust mechanism providing an exhaust for excess gas flow within the substrate production tool;

providing a substrate transfer section coupled below the housing and in airflow communication with the facility connection, the substrate transfer section partially containing a clock-arm substrate carrier mechanism having a plurality of carrier arms each having a midpoint and a respective drive between opposing ends and arranged to rotate about the midpoint in planes parallel to one another, the respective drive coupled to each of the plurality of carrier arms to move respective ones of the plurality of carrier arms in at least a 360 degree arc in either direction simultaneously, the substrate transfer section further having a linear substrate traverser mechanism having a plurality of linear substrate carriers mounted thereon, each of the plurality of linear substrate carriers being configured to transport the substrates in a plane substantially parallel to the planes of the plurality of carrier arms with each of the plurality of linear substrate carriers being in a different plane from one another;

maintaining a substrate process area of the substrate production tool at a lower pressure than a pressure of the substrate transfer section of the substrate production tool;

maintaining the substrate process area at a higher pressure than a pressure of the reduced pressure exhaust mechanism; and

maintaining the substrate transfer section at a higher pressure than the pressure of the reduced pressure exhaust mechanism.

32. The method of claim 31, further comprising providing one or more substrate transport slots between the substrate process area and the substrate transfer section to maintain the low pressure in the substrate process area relative to the substrate transfer section.

33. The method of claim 31, further comprising arranging the substrate transfer section and the substrate process area to be located substantially horizontal relative to one another to reduce particle transport between the substrate transfer section and the substrate process area.

34. The method of claim 31, further comprising providing a chemical processing section within the substrate process area.

35. The method of claim 34, wherein maintaining the low pressure in the substrate process area relative to the substrate transfer section is to substantially contain chemical vapors within the chemical processing section from reaching the substrate transfer section.

CLAIMS

What is claimed is:

1. A system to reduce particle contamination on substrates, the system comprising:
a substrate traverser mechanism having one or more tracks to transport substrate carriers;
one or more traverser ducts arranged to at least partially surround the one or more tracks, the one or more ducts having slits along at least a substantial portion of a length of the one or more tracks; and
a traverser exhaust fan coupled to one end of each of the one or more traverser ducts, the traverser exhaust fan to provide sufficient volumetric airflow to provide a velocity of the volumetric airflow through the slits greater than a terminal settling velocity of a predetermined particle size, the traverser exhaust fan further to draw particles less than about the predetermined particle size generated by the substrate traverser mechanism into the one or more traverser ducts.
2. The system of claim 1, wherein the one or more traverser ducts have a differing cross-sectional area along the length to balance a pressure drop from the traverser exhaust fan allowing a substantially uniform airflow velocity along a length of the slits.
3. The system of claim 1, wherein the terminal settling velocity is determined for the predetermined particle size being less than about 50 μm .

4. A system to reduce particle contamination on substrates, the system comprising:
- a housing to couple a substrate production tool to a fan filter unit, the fan filter unit to provide filtered air to the housing;
 - a facility connection to couple the substrate production tool to a reduced pressure exhaust mechanism;
 - a substrate transfer section coupled below the housing and in airflow communication with the facility connection, the substrate transfer section partially containing a clock-arm substrate carrier mechanism having a plurality of carrier arms each having a midpoint between opposing ends and arranged to rotate about the midpoint in planes parallel to one another, the substrate transfer section further having a linear substrate traverser mechanism having a plurality of linear substrate carriers mounted thereon, each of the plurality of linear substrate carriers being configured to transport the substrates in a plane substantially parallel to the planes of the plurality of carrier arms with each of the plurality of linear substrate carriers being in a different plane from one another;
 - a substrate process area coupled to the substrate transfer section by one or more substrate transport slots, the clock-arm substrate carrier mechanism being arranged to transport the substrates between the substrate process area and the substrate transfer section via the one or more substrate transport slots; and
 - a chamber substantially containing the substrate transfer section and the substrate process area, the chamber being coupled to the housing to receive the filtered air and coupled to the facility connection to provide an exhaust for excess gas flow, the chamber being configured to maintain a low pressure in the substrate process area relative to the substrate transfer section.

5. The system of claim 4, further comprising at least one peripheral substrate transport slot positioned proximal to an outer periphery of a rotational path traversed by the plurality of carrier arms and to one end of the linear substrate traverser mechanism, the at least one peripheral substrate transport slot being configured to receive the substrates into and out from the chamber from a substrate enclosure, the at least one peripheral substrate transport slot arranged to be maintained at a low pressure relative to the substrate enclosure.
6. The system of claim 4, wherein the linear substrate traverser mechanism further comprises:
at least two upper tracks;
at least two lower tracks; and
linear drive mechanisms respectively coupled to each of the at least two upper tracks and the two lower tracks, each of the plurality of linear substrate carriers mechanically coupled to a unique one of the linear drive mechanisms.
7. The system of claim 6, wherein the linear substrate traverser mechanism is positioned between the housing and the facility connection, a volume in which the linear substrate traverser mechanism operates is configured to be at a higher pressure than a pressure at the facility connection to draw particles generated by the linear drive mechanisms into the reduced pressure exhaust mechanism during operation.
8. The system of claim 4, wherein the one or more substrate transport slots are arranged to maintain the low pressure in the substrate process area relative to the substrate transfer section.
9. The system of claim 4, wherein the chamber is further configured to maintain a high pressure in the substrate transfer section relative to the facility connection.

10. The system of claim 4, wherein the chamber is further configured to maintain a high pressure in the substrate process area relative to the facility connection.
11. The system of claim 4, wherein the chamber further includes a substrate port to receive the substrates into and out from the chamber from a substrate enclosure, the substrate port to be maintained at a low pressure relative to the substrate enclosure.
12. The system of claim 4, wherein the substrate process area includes a chemical process section, and wherein the chamber being configured to maintain a low pressure in the substrate process area relative to the substrate transfer section is to substantially contain chemical vapors within the chemical process section from reaching the substrate transfer section.

13. A method of reducing particle contamination on substrates, the method comprising:
- providing a housing to couple a substrate production tool to a fan filter unit, the fan filter unit providing filtered air to the substrate production tool;
 - providing a facility connection to couple the substrate production tool to a reduced pressure exhaust mechanism, the reduced pressure exhaust mechanism providing an exhaust for excess gas flow within the substrate production tool;
 - providing a substrate transfer section coupled below the housing and in airflow communication with the facility connection, the substrate transfer section partially containing a clock-arm substrate carrier mechanism having a plurality of carrier arms each having a midpoint between opposing ends and arranged to rotate about the midpoint in planes parallel to one another, the substrate transfer section further having a linear substrate traverser mechanism having a plurality of linear substrate carriers mounted thereon, each of the plurality of linear substrate carriers being configured to transport the substrates in a plane substantially parallel to the planes of the plurality of carrier arms with each of the plurality of linear substrate carriers being in a different plane from one another;
 - maintaining a substrate process area of the substrate production tool at a lower pressure than a pressure of the substrate transfer section of the substrate production tool;
 - maintaining the substrate process area at a higher pressure than a pressure of the reduced pressure exhaust mechanism; and
 - maintaining the substrate transfer section at a higher pressure than the pressure of the reduced pressure exhaust mechanism.
14. The method of claim 13, further comprising providing one or more substrate transport slots between the substrate process area and the substrate transfer section to maintain the low pressure in the substrate process area relative to the substrate transfer section.

15. The method of claim 14, wherein maintaining the low pressure in the substrate process area relative to the substrate transfer section is to substantially contain chemical vapors within the chemical processing section from reaching the substrate transfer section.