Claims

1. A system for handling components, the system comprising:

a turret assembly comprising:

a turret rotatable about a horizontal axis; and

a plurality of end effectors attached to and arranged peripherally around the turret, the end effectors aligned radially from the horizontal axis;

a support assembly arranged to move a source substrate to a retrieval position, the support assembly arranged vertically to the turret assembly such that an end effector of the plurality of end effectors is positioned above a component in an X-Y-Θ coordinate position of the source substrate; and

a component transfer assembly arranged to move a component transfer medium to a component release position corresponding to the X-Y-Θ coordinate position of the source substrate for receiving the singulated components from the end effectors, the component transfer assembly arranged vertically to the turret assembly,

an image capture device aligned radially from the horizontal axis and configured for capturing images of the singulated components held by the end effectors during rotation of the turret,

wherein any deviation of the singulated component X-Y-Θ coordinate position captured by the image capture device is corrected or compensated by way of the component transfer assembly prior to placement of the singulated component on the component transfer medium.

2. The system of claim 1, wherein the support assembly is disposed below the turret assembly and the component transfer assembly is disposed above the turret assembly.

3. The system of claim 1, further comprising a computer system configured for calculating misalignment of the held singulated components based on the captured images.

4. The system of claim 1, wherein the misalignment is calculated relative to a digital map of the source substrate, the digital map identifying locations of the singulated components relative to the source substrate.

5. The system of claim 4, wherein the digital map further identifies locations of defective singulated components.

6. The system of claim 1, further comprising a component transfer actuation mechanism for actuating the component transfer assembly for correcting the misalignment.

7. The system of claim 1, further comprising a support actuation mechanism for actuating the support assembly for aligning the singulated components of the source substrate to the end effectors.

8. The system of claim 7, comprising a first end effector and a second end effector such that in one instance of the turret rotation, the first end effector is in position to vertically place a first singulated component on the component transfer medium; and the second end effector is in position to vertically pick a second singulated component from the source substrate.

9. The system of claim 8, further comprising a third end effector such that in one instance of the turret rotation, the third end effector is holding a third singulated component and is in position for capturing an image of the third singulated component.

10. The system of claim 9, wherein each end effector comprises a suction nozzle.

11. The system of claim 1, wherein the support assembly comprises a highly planar or ultra-planar wafer table for supporting the source substrate being a semiconductor wafer.

12. A method for handling components, the method comprising:

moving a source substrate on a support assembly to a retrieval position, the support assembly positioned vertically to a turret assembly such that an end effector of the plurality of end effectors is positioned above a component in an X-Y-Θ coordinate position of the source substrate;

moving a component transfer medium on a component transfer assembly to the component release position corresponding to the X-Y-Θ coordinate position of the source substrate, the component transfer assembly arranged vertically to the turret assembly, the component transfer medium for receiving the singulated components from a plurality of end effectors of the turret assembly;

rotating a turret of the turret assembly about a horizontal axis, the end effectors attached to and arranged peripherally around the turret and aligned radially from the horizontal axis;

capturing images of the singulated components held by the end effectors during rotation of the turret by an image capture device aligned radially from the horizontal axis;

during rotation of the turret, actuating the end effectors to continually pick the singulated components from the source substrate and place the picked singulated components on the component transfer medium,

correcting or compensating by way of the component transfer assembly, any deviation of the singulated component X-Y-Θ coordinate position captured by the image capture device prior to placement of the singulated component on the component transfer medium.

13. The method of claim 12, wherein the support assembly is disposed below the turret assembly and the component transfer assembly is disposed above the turret assembly.

14. The method of claim 12, further comprising calculating misalignment of the held singulated components based on the captured images.

15. The method of claim 14, wherein the misalignment is calculated relative to a digital map of the source substrate, the digital map identifying locations of the singulated components relative to the source substrate.

16. The method of claim 15, wherein correcting or compensating any deviation of the singulated component X-Y-Θ coordinate position comprises actuating the component transfer assembly for correcting the misalignment.

17. The method of claim 12, wherein moving a component transfer medium on a component transfer assembly to the component release position corresponding to the X-Y-Θ coordinate position of the source substrate comprises actuating the support assembly for aligning the singulated components of the source substrate to the end effectors.

18. The method of any one of claims 12 to 17, comprising rotating a first end effector and a second end effector along with the turret such that in one instance of said rotating:

the first end effector is in position to vertically place a first singulated component on the component transfer medium; and

the second end effector is in position to vertically pick a second singulated component from the source substrate.

19. The method of claim 18, comprising rotating a third end effector along with the turret such that in one instance of said rotating, the third end effector is holding a third singulated component and is in position for capturing one or more images of the third singulated component.

20. The method of claim 12, wherein the source substrate is a semiconductor wafer, the singulated components are semiconductor dies, and/or the component transfer medium is a die attach film.

21. The turret assembly of claim 12, wherein each end effector comprises a suction nozzle.