Claims:

1. A method for cleaning a pick-and-place apparatus of a semiconductor device handling machine that is used for packaged semiconductor device testing, the method comprising:

positioning an elastomeric cleaning material near a pick-and-place apparatus connected to a semiconductor device handling machine, the pick-and-place apparatus having a contact element that is one of a vacuum aperture, a nozzle, a suction cup, a suction inlet, a vacuum collet, and a vacuum pick-up tool wherein each contact element has an inner surface and an outer surface and the elastomeric cleaning material having a top layer having a surface tackiness and a textured surface that is contacted by the contact element during a cleaning process to clean an inner surface and an outer surface of the contact element, wherein the top layer has a plurality of microfeatures that clean an inner and outer surface of the contact element, the plurality of microfeatures having a spacing between the microfeatures, a moment of inertia of each microfeature and a total length of each microfeature determined based on at least a diameter of the contact element;

inserting, while the pick-and-place apparatus remains attached to the semiconductor device handling machine, the pick-and-place apparatus onto and into the elastomeric cleaning material so that the contact element is inserted into the elastomeric cleaning material;

transferring, by the surface tackiness of the elastomeric cleaning material, debris from the contact element to the elastomeric cleaning material; and

cleaning, by the textured surface of the elastomeric cleaning material, the inner surface and the outer surface of the contact element.

2. The method of claim 1 further comprising moving the elastomeric cleaning material adjacent to the pick-and-place apparatus.

3. The method of claim 1 further comprising trapping the debris within the elastomeric cleaning material.

4. The method of claim 1, wherein the elastomeric cleaning material has a cross linked polymer layer.

5. The method of claim 4, wherein the elastomeric cleaning material further

comprises one or more intermediate layers underneath the cross linked polymer layer, wherein the one or more intermediate layers include one of a rigid layer, a compliant layer, and/or a combination of a rigid layer and a compliant layer.

6. The method of claim 1, wherein positioning the elastomeric cleaning material further comprises using the semiconductor device handling machine to position the elastomeric cleaning material and to move a plurality of semiconductor devices during a package test process.

7. The method of claim 5, wherein the elastomeric cleaning material further comprises a carrier underneath the one or more intermediate layers.

8. The method of claim 7, wherein the elastomeric cleaning material has a specific gravity ranging from 0.75 to 2.27, an elasticity ranging from 40-MPa to 600-MPa, a thickness ranging from 25-um and 500-um, and a porosity ranging from 10 to 150 micropores per inch.

9. A method for cleaning a pick-and-place apparatus of a surface mount technology (SMT) component placement machine, the method, comprising:

positioning an elastomeric cleaning material near a pick-and-place apparatus connected to a SMT machine, the pick-and-place apparatus having a contact element that is one of a vacuum aperture, a nozzle, a suction cup, a suction inlet, a vacuum collet, and a vacuum pick-up tool, each having an inner surface and an outer surface, the elastomeric cleaning material having a top layer having a surface tackiness, wherein the top layer has a plurality of microfeatures having a textured surface, a spacing between the microfeatures, a moment of inertia of each microfeature and a total length of each microfeature determined based on at least a diameter of the contact element, wherein the plurality of microfeatures clean an inner surface and an outer surface of the contact element; and

inserting, while the pick-and-place apparatus remains attached to the SMT machine, the contact element of the pick-and-place apparatus onto and into the elastomeric cleaning material;

transferring, by the surface tackiness of the elastomeric cleaning material, debris from one or more surfaces of the contact element to the elastomeric material; and

cleaning, by the textured surface of the elastomeric cleaning material, the inner surface and the outer surface of the contact element of the pick and place apparatus.

10. The method of claim 9 further comprising moving the elastomeric cleaning material adjacent to the pick-and-place apparatus.

11. The method of claim 9 further comprising trapping the debris within the elastomeric cleaning material.

12. The method of claim 9, wherein the elastomeric cleaning material has a cross linked polymer layer.

13. The method of claim 12, wherein the elastomeric cleaning material further comprises one or more intermediate layers underneath the cross linked polymer layer, wherein the one or more intermediate layers include one of a rigid layer, a compliant layer, and/or a combination of a rigid layer and a compliant layer.

14. The method of claim 9, wherein positioning the elastomeric cleaning material further comprises using the SMT machine to position the elastomeric cleaning material and to move a plurality of semiconductor devices during a printed circuit board assembly process.

15. The method of claim 13, wherein the elastomeric cleaning material further comprises a carrier underneath the one or more intermediate layers.

16. The method of claim 15, wherein the elastomeric cleaning material has a specific gravity ranging from 0.75 to 2.27, an elasticity ranging from 40-MPa to 600-MPa, a thickness ranging from 25-um and 500-um, and a porosity ranging from 10 to 150 micropores per inch.

17. A method for cleaning a pick-and-place apparatus of a die attach or a flip chip bonder machine, the method, comprising:

positioning an elastomeric cleaning material near a pick-and-place apparatus connected to the die attach or the flip chip bonder machine, the pick-and-place apparatus having a contact element that is one of a vacuum aperture, a nozzle, a suction cup, a suction inlet, a vacuum collet, and a vacuum pick-up tool, wherein each contact element has an inner surface and an outer surface and wherein the elastomeric cleaning material has a top layer having a surface tackiness, wherein the top layer has a plurality of microfeatures having a

textured surface, a spacing between the microfeatures, a moment of inertia of each microfeature and a total length of each microfeature determined based on at least a diameter of the contact element, wherein the plurality of microfeatures clean an inner surface and an outer surface of the contact element;

inserting, while the pick-and-place apparatus remains attached to the die attach or the flip chip bonder machine, the pick-and-place apparatus onto and into the elastomeric cleaning material so that the contact element;

transferring, by the surface tackiness of the elastomeric cleaning material, debris from one or more surfaces of the contact element to the elastomeric material; and

cleaning, by the textured surface of the elastomeric cleaning material, the inner surface and the outer surface of the contact element.

18. The method of claim 17 further comprising moving the elastomeric cleaning material adjacent to the pick-and-place apparatus.

19. The method of claim 17 further comprising trapping the debris within the elastomeric cleaning material.

20. The method of claim 17, wherein the elastomeric cleaning material has a cross linked polymer layer.

21. The method of claim 20, wherein the elastomeric cleaning material further comprises one or more intermediate layers having predetermined characteristics underneath the cross linked polymer layer.

22. The method of claim 17, wherein positioning the elastomeric cleaning material further comprises using the die attach or the flip chip bonder machine to position the elastomeric cleaning material and to move a plurality of semiconductor devices during a printed circuit board assembly process.

23. The method of claim 22, wherein the elastomeric cleaning material further comprises a carrier underneath the one or more intermediate layers.

24. The method of claim 23, wherein the elastomeric cleaning material has a specific gravity ranging from 0.75 to 2.27, an elasticity ranging from 40-MPa to 600-MPa, a thickness ranging from 25-um and 500-um, and a porosity ranging from 10 to 150 micropores

per inch.

25. An apparatus, comprising:

a semiconductor device handling machine having a pick and place apparatus, the pick and place apparatus having a contact element with an inner surface and an outer surface and the contact element contacts and picks one of a device and a component using suction;

a cleaning material attached to a substrate that is positioned adjacent to the pick and place apparatus, the cleaning material having a top layer that is contacted by the contact element of the pick and place apparatus during a cleaning process wherein the top layer has a surface tackiness that causes a piece of debris on the contact element to transfer to the cleaning material and a plurality of microfeatures having a textured surface, a spacing between the microfeatures, a moment of inertia of each microfeature and a total length of each microfeature determined based on at least a diameter of the contact element of the pick and place apparatus, wherein the plurality of microfeatures including the textured surface clean an inner surface and an outer surface of the contact element; and

wherein the contact element is cleaned while the contact element is attached to the pick and place apparatus by inserting an end of the contact element into a cleaning material; and

wherein the pick and place apparatus performs a pick and place operation once the contact element is cleaned.

26. The apparatus of claim 25, wherein the cleaning material further comprises a surface tackiness that causes a piece of debris on the contact element to transfer to the cleaning material.

27. The apparatus of claim 25, wherein the cleaning material further comprises a cleaning pad layer that has one or more microfeatures formed in the cleaning pad layer.

28. The apparatus of claim 27, wherein the one or more microfeatures are one of microcolumns and micropyramids.

29. The apparatus of claim 27, wherein the cleaning material further comprises one or more intermediate layers underneath the cleaning pad layer that support the cleaning pad layer.

30. The apparatus of claim 29, wherein the intermediate layers are one of rigid layers, compliant layers and rigid and compliant layers.

31. The apparatus of claim 29, wherein the cleaning material further comprises a release layer on top of a top surface of the cleaning pad layer that protects the cleaning pad layer.

32. The apparatus of claim 25, wherein the cleaning material further comprises a substrate on top of which a cleaning pad layer is supported.

33. The apparatus of claim 25, wherein the pick and place apparatus is one of a pick and place apparatus for a packaged device being tested or a pick and place apparatus for a component used in a surface mount process.

34. The apparatus of claim 25, wherein the pick and place apparatus is one of a pick and place apparatus for a die attach machine or a pick and place apparatus for a flip-chip bonder machine.

35. The apparatus of claim 25, wherein the contact element is one of a vacuum aperture, a nozzle, a suction cup, a suction inlet, or a vacuum collet of the pick and place apparatus.

36. The apparatus of claim 25, wherein the plurality of microfeatures are arranged in an array of streets, avenues or diagonals that decouple each microfeature from each other microfeature and a width of each street, avenue or diagonal is based on a dimension of the contact element of the pick and place apparatus.

37. A method for picking and placing semiconductor elements, the method comprising:

performing a pick and place operation on a semiconductor device using a contact element of a pick and place apparatus, the contact element having an inner surface and an outer surface;

cleaning the contact element of the pick and place apparatus while the contact element is attached to the pick and place apparatus, wherein cleaning the contact element further comprises inserting an end of the contact element into a cleaning material having a top surface with a tackiness that attracts debris from the contact element and a plurality of microfeatures having a textured surface, a spacing between the microfeatures, a moment of inertia of each microfeature and a total length of each microfeature determined based on at least a diameter of the contact element, wherein the plurality of microfeatures clean an inner surface and an outer surface of the contact element; and

performing the pick and place operation once the contact element is cleaned.

38. The method of claim 37, wherein cleaning the contact element further comprises transferring a piece of debris from a surface of the contact element to the cleaning material.

39. The method of claim 38, wherein transferring a piece of debris from a surface of the contact element further comprises attracting the piece of debris using a surface tackiness of a top surface of the cleaning material.

40. The method of claim 39, wherein transferring a piece of debris from a surface of the contact element further comprises transferring a piece of debris from an inner surface of the contact element to the surface of the cleaning material.

41. The method of claim 37, wherein performing the pick and place operation further comprises one of performing the pick and place operation for a packaged device being tested or performing the pick and place operation for a component used in a surface mount process.

42. The method of claim 37, wherein performing the pick and place operation further comprises one of performing the pick and place operation for a die attach machine or performing the pick and place operation for a flip-chip bonder machine.

43. The method of claim 37, wherein cleaning the contact element further comprises positioning the cleaning material adjacent to the pick and place apparatus.

44. The method of claim 37, wherein the contact element is one of a vacuum aperture, a nozzle, a suction cup, a suction inlet, or a vacuum collet of the pick and place apparatus.