What is claimed is:

1. A cleaning material with a functionalized surface for cleaning the contact elements and support structures of testing interfaces used for wafer level or package level IC semiconductor device testing, the cleaning material comprising:

a cleaning media having a cleaning media base reference plane and a plurality of functionalized microfeatures ~~that~~arranged in an array having a plurality of rows and a plurality of columns of functionalized microfeatures and each ~~have~~functionalized microfeature has a body with a width and a height, a spacing between each body and dimensional properties that optimize the cleaning media so that the contact area and surrounding support hardware are cleaned without modification or damage, each functionalized microfeature extending ~~away from a top surface of~~above the cleaning media base reference plane and the cleaning media having a plurality of abrasive particles having a Mohs Hardness of 7 or greater uniformly distributed within the body of each functionalized microfeature;

a cleaning layer applied across ~~the~~a top surface of the cleaning media- having predetermined characteristics that clean contaminants from the pin contact elements and support hardware~~; and~~ , the cleaning layer applied on top of all of the functionalized microfeatures and within the spacing between each functionalized microfeature down to the cleaning media base reference plane; and

one or more intermediate rigid or compliant underlayers underneath the cleaning media, wherein each underlayer has a modulus of elasticity range between more than 40-MPa to 600-MPa, each layer has a thickness between 25-um and 300-um and each layer has a hardness between 30 Shore A and 90 Shore A.

2. The cleaning material of claim 1, wherein the plurality of functionalized microfeature is one ~~or~~of uniformly shaped across the cleaning media and variably spaced across the cleaning media.

3. The cleaning material of claim 1, wherein the plurality of abrasive particles further comprises one or more kinds of particles selected from the group consisting of aluminum oxide, silicon carbide, and diamond.

4. The cleaning material of claim 1, wherein the cleaning layer further comprises a polymer layer that is 10 to ~~100um~~100 um thick that has a predetermined specific gravity, elasticity, tackiness, planarity, thickness and porosity.

5. The cleaning material of claim 1, wherein the cleaning layer further comprises a layer of abrasive polymer with a plurality of abrasive particles having a Mohs Hardness of 7 or greater and is 10 to ~~100um~~100 um thick across the top surface of the cleaning media.

6. The cleaning material of claim 1, wherein each ~~microfeature further comprises a~~ positive ~~microfeature that extends upwards away from the top surface of the cleaning media.~~

~~7. The cleaning material of claim 6, wherein each positive~~functionalized microfeature is one of a micro-pyramid, a micro-column and a curved micro-pyramid.

~~8~~7. The cleaning material of claim ~~6~~1, wherein the cleaning layer is applied over the body of each positive microfeature wherein the body of each positive functionalized microfeature has a face and the cleaning layer is applied over the face of each positive functionalized microfeature.

~~9~~8. The cleaning material of claim ~~6~~1, wherein the cleaning layer has a flat top surface opposite the top surface of the cleaning media.

9. The cleaning material of claim 1, wherein each functionalized microfeatures extends above the cleaning media base reference plane in a range of 25 micrometers to 500 micrometers, has a top surface farthest away from the cleaning media base reference plane of more than 20 micrometers and the spacing between each functionalized microfeature is in the range from 50 micrometers and 250 micrometers.

10. The cleaning material of claim 1, wherein the cleaning layer further comprises a plurality of abrasive particles having a Mohs Hardness of 7 or greater with a thickness less than ~~10um~~10 um applied across a top surface of each positive functionalized microfeature and along the body of each positive functionalized microfeature.

~~10~~11. The cleaning material of claim ~~9~~10, wherein the plurality of abrasive particles are a blend of one or more types of particles selected from the group consisting of aluminum oxide, silicon carbide, and diamond.

~~11. The cleaning material of claim 1, wherein each microfeature further comprises a negative microfeature that extends downwards away from the top surface of the cleaning media.~~

~~12. The cleaning material of claim 11, wherein each negative microfeature is one of a micro-pyramid, a micro-column and a curved micro-pyramid.~~

~~13. The cleaning material of claim 11, wherein the cleaning layer is applied across the top surface of the cleaning media and into a cavity of each negative microfeature and along an interior surface of each negative microfeature.~~

~~14. The cleaning material of claim 11, wherein the cleaning layer further comprises a plurality of abrasive particles having a Mohs Hardness of 7 or greater with a thickness less than 10um applied across the top surface of the cleaning media and into a cavity of each negative microfeature and along an interior surface of each negative microfeature.~~

~~15. The cleaning material of claim 14, wherein the plurality of abrasive particles are a blend of one or more types of particles selected from the group consisting of aluminum oxide, silicon carbide, and diamond.~~

~~16. A method for cleaning contact elements and support structures of a testing interface used for wafer level or package level IC semiconductor device testing, the method comprising:~~

~~performing a testing operation of the wafer level or package level IC semiconductor devices; and~~

~~performing a cleaning operation using a cleaning device that has a cleaning media having a plurality of functionalized microfeatures that each have a body with a width a height, a spacing between each body and dimensional properties that optimize the cleaning media so that the contact area and surrounding support hardware are cleaned without modification or damage, each microfeature extending away from a top surface of the cleaning media and the cleaning media having a plurality of abrasive particles having a Mohs Hardness of 7 or greater uniformly distributed within the body of each microfeature, a cleaning layer applied across the top surface of the cleaning media having predetermined characteristics that clean contaminants from the pin contact elements and support hardware~~

and one or more intermediate rigid or compliant underlayers underneath the cleaning media, wherein each underlayer has a modulus of elasticity range between more than 40 MPa to 600 MPa, each layer has a thickness between 25 um and 300 um and each layer has a hardness between 30 Shore A and 90 Shore A.

17. The method of claim 16, wherein performing a cleaning operation using a cleaning device further comprises using a polymer layer that is 10 to 100um thick that has a predetermined specific gravity, elasticity, tackiness, planarity, thickness and porosity.

18. The method of Claim 16, wherein performing a cleaning operation using a cleaning device further comprises using a plurality of positive microfeatures that extends upwards away from the top surface of the cleaning media.

19. The method of Claim 16, wherein performing a cleaning operation using a cleaning device further comprises using a plurality of negative microfeature that extends downwards away from the top surface of the cleaning media.

20. A cleaning device for cleaning pin contact elements and support hardware in a semiconductor testing apparatus, the cleaning device comprising:

a cleaning media with a plurality of geometrical surface features that emulate solder balls, pillars, copper pillar bumps, and/or gold bumps of a semiconductor device under test wherein the cleaning balls and cleaning pillars are further comprised of a plurality of abrasive particles distributed within the features and having a Mohs Hardness of 7 or greater for cleaning contact elements and support structures of testing interfaces;

a cleaning layer applied across a top surface of each geometric surface feature and along a side of each geometric surface feature having predetermined characteristics that clean contaminants from the pin contact elements and support hardware; and

a substrate onto which the cleaning media is attached, having a configuration suitable to be introduced into the testing apparatus during normal testing operating of the testing apparatus, wherein the substrate comprises a surrogate semiconductor wafer or packaged IC device.

~~21. The cleaning device of claim 20 further comprising a plurality of abrasive particles that are applied across the top surface and along the sides of each geometric surface feature.~~

~~22. The cleaning device of claim 20, wherein the cleaning layer further comprises a layer of polymer with a thickness of between 10 um and 100um that has a determined specific gravity, elasticity, tackiness, planarity, thickness and porosity.~~

~~23. The cleaning device of claim 20, wherein the cleaning layer further comprises a layer of abrasive polymer with a plurality of abrasive particles having a Mohs Hardness of 7 or greater with a thickness of between 10 um and 100um.~~

~~24. The cleaning device of claim 20, wherein the cleaning layer further comprises a layer of abrasive polymer with a plurality of abrasive particles having a Mohs Hardness of 7 or greater with a thickness of less than 10 um.~~

~~25. The cleaning device of claim 24, wherein the plurality of abrasive particles further comprises a blend of one or more types of particles selected from the group consisting of aluminum oxide, silicon carbide, and diamond.~~

~~26. A method for cleaning pin contact elements and support hardware in a semiconductor testing apparatus, the method comprising:~~

~~performing testing of a device under test having a predetermined configuration of one of solder balls, pillars, copper-pillar bumps, and gold bumps; and~~

~~performing cleaning of the pin contact elements and support hardware using a cleaning device having a cleaning media with a plurality of geometrical surface features that emulate wherein the cleaning balls and cleaning pillars are further comprised of a plurality of abrasive particles distributed within the features and having a Mohs Hardness of 7 or greater for cleaning contact elements and support structures of testing interfaces, a cleaning layer applied across a top surface of each geometric surface feature and along a side of each geometric surface feature having predetermined characteristics that clean contaminants from the pin contact elements and support hardware and a substrate onto which the cleaning media is attached, having a configuration suitable to be introduced into the testing apparatus during~~

~~normal testing operating of the testing apparatus, wherein the substrate comprises a surrogate semiconductor wafer or packaged IC device.~~

~~27. A cleaning material with a functionalized surface for cleaning a capillary tube of a wire bonding machine, the cleaning material comprising:~~

~~a cleaning media having a plurality of functionalized microfeatures that each have a body with a width a height, a spacing between each body and dimensional properties that optimize the cleaning media so that the contact area and surrounding support hardware are cleaned without modification or damage, each microfeature extending away from a top surface of the cleaning media and the cleaning media having a plurality of abrasive particles having a Mohs Hardness of 7 or greater uniformly distributed within the body of each microfeature;~~

~~a cleaning layer applied across the top surface of the cleaning media having predetermined characteristics that clean contaminants from one or more surface of the capillary tube; and~~

~~one or more intermediate rigid or compliant underlayers underneath the cleaning media, wherein each underlayer has a modulus of elasticity range between more than 40 MPa to 600 MPa, each layer has a thickness between 25 um and 300 um and each layer has a hardness between 30 Shore A and 90 Shore A.~~

~~28. The cleaning material of claim 27, wherein the plurality of functionalized microfeature is one or uniformly shaped across the cleaning media and variably spaced across the cleaning media.~~

~~29. The cleaning material of claim 27, wherein the plurality of abrasive particles further comprises one or more kinds of particles selected from the group consisting of aluminum oxide, silicon carbide, and diamond.~~

~~30. The cleaning material of claim 27, wherein the cleaning layer further comprises a polymer layer that is 10 to 100um thick that has a predetermined specific gravity, elasticity, tackiness, planarity, thickness and porosity.~~

~~31. The cleaning material of claim 27, wherein the cleaning layer further comprises a layer of abrasive polymer with a plurality of abrasive particles having a Mohs Hardness of 7 or greater 10 to 100um thick across the top surface of the cleaning media.~~

~~32. The cleaning material of claim 27, wherein each microfeature further comprises a positive microfeature that extends upwards away from the top surface of the cleaning media.~~

~~33. The cleaning material of claim 32, wherein each positive microfeature is one of a micro-pyramid, a micro-column and a curved micro-pyramid.~~

~~34. The cleaning material of claim 32, wherein the cleaning layer is applied over the body of each positive microfeature wherein the body of each positive microfeature has a face and the cleaning layer is applied over the face of each positive microfeature.~~

~~35. The cleaning material of claim 32, wherein the cleaning layer further comprises a plurality of abrasive particles having a Mohs Hardness of 7 or greater with a thickness less than 10um applied across a top surface of each positive microfeature and along the body of each positive microfeature.~~

~~36. The cleaning material of claim 35, wherein the plurality of abrasive particles are a blend of one or more types of particles selected from the group consisting of aluminum oxide, silicon carbide, and diamond.~~

~~37. The cleaning material of claim 27, wherein each microfeature further comprises a negative microfeature that extends downwards away from the top surface of the cleaning media.~~

~~38. The cleaning material of claim 37, wherein each negative microfeature is one of a micro-pyramid, a micro-column and a curved micro-pyramid.~~

~~39. The cleaning material of claim 37, wherein the cleaning layer is applied across the top surface of the cleaning media and into a cavity of each negative microfeature and along an interior surface of each negative microfeature.~~

~~40. The cleaning material of claim 37, wherein the cleaning layer further comprises a plurality of abrasive particles having a Mohs Hardness of 7 or greater with a thickness less than 10um applied across the top surface of the cleaning media and into a~~

~~cavity of each negative microfeature and along an interior surface of each negative microfeature.~~

~~41. The cleaning material of claim 40, wherein the plurality of abrasive particles are a blend of one or more types of particles selected from the group consisting of aluminum oxide, silicon carbide, and diamond.~~

~~42. A method for cleaning a capillary tube of a wire bonding machine, the method comprising:~~

~~performing a wire bonding operation using the capillary tube of the wire bonding machine; and~~

~~performing a cleaning operation using a cleaning device that has a cleaning media having a plurality of functionalized microfeatures that each have a body with a width a height, a spacing between each body and dimensional properties that optimize the cleaning media so that one or more surfaces of the capillary tube are cleaned without modification or damage, each microfeature extending away from a top surface of the cleaning media and the cleaning media having a plurality of abrasive particles having a Mohs Hardness of 7 or greater uniformly distributed within the body of each microfeature, a cleaning layer applied across the top surface of the cleaning media having predetermined characteristics that clean contaminants from the one or more surfaces of the capillary tube and one or more intermediate rigid or compliant underlayers underneath the cleaning media, wherein each underlayer has a modulus of elasticity range between more than 40 MPa to 600 MPa, each layer has a thickness between 25 um and 300 um and each layer has a hardness between 30 Shore A and 90 Shore A.~~

~~43. The method of claim 42, wherein performing a cleaning operation using a cleaning device further comprises using a polymer layer that is 10 to 100um thick that has a predetermined specific gravity, elasticity, tackiness, planarity, thickness and porosity.~~

~~44. The method of Claim 42, wherein performing a cleaning operation using a cleaning device further comprises using a plurality of positive microfeatures that extends upwards away from the top surface of the cleaning media.~~

~~45. The method of Claim 42, wherein performing a cleaning operation using a cleaning device further comprises using a plurality of negative microfeature that extends downwards away from the top surface of the cleaning media.~~

~~46. The method of claim 42, wherein performing the cleaning operation further comprising performing the cleaning operation of the capillary tube without removing the capillary tube from the wire bonding device.~~

~~47. The method of claim 46 further comprising resuming the wire bonding operation once the cleaning operation is completed.~~

~~48. The method of claim 42, wherein performing the cleaning operation further comprising performing the cleaning operation of the capillary tube after a predetermined period of time.~~