Claims

What is claimed is:

1. A method of forming an electrical connector, the method comprising:
affixing at least one layer to a core such that the at least one layer is isomorphic to at least a portion of on an external surface of the core;
press fitting the core with the at least one layer into a socket cavity in a socket body, where the socket cavity comprises an internal surface;
removing the core from the socket cavity while leaving at least a portion of the layer so that the layer forms a shell layer affixed to the internal surface of the socket cavity, the shell layer further comprising a shell cavity with an internal shell surface; and
inserting at least one plunger and a biasing device into the shell cavity so that a tail of the at least one plunger is slidably received in the shell cavity and the biasing device biases a tip of the at least one plunger away from the internal surface of the shell cavity.

2. The method of claim 1, further comprising:
forming a plurality of neck portions in a wire such that the wire includes the plurality of neck portions and a plurality of body portions;
cutting the core from the wire, the core including one of the neck portions and one of the body portions.

3. The method of claim 1, further comprising cutting the core from a wire of substantially constant cross-section.

4. The method of claim 1, wherein:
the internal surface of the socket cavity includes a neck portion and a body portion;
the external surface of the core with the at least one layer includes a neck portion and a body portion; and

the core with the at least one layer is press fit into the socket cavity in the socket body such that the neck portion of the external surface of the core with the at least one layer is proximal to at least a portion of the neck portion of the internal surface of the socket cavity and the body portion of the external surface of the core with the at least one layer is proximal to at least a portion of the body portion of the internal surface of the socket cavity.

5. The method of claim 1, wherein the layer is formed by plating a plating alloy.

6. The method of claim 5, wherein the plating alloy includes at least one material selected from: gold and nickel.

7. The method of claim 5, wherein forming the layer includes:
plating a first layer formed of a first plating alloy on the external surface of the core; and
plating a second layer formed of a second plating alloy on an external surface of the first layer.

8. The method of claim 7, wherein the first plating alloy comprises gold and the second plating alloy comprises nickel.

9. The method of claim 1, wherein the core with the at least one layer includes a first end and a second end, at least one of the first end and the second end extending outward from the socket body, the method further comprising:
removing at least a portion of the at least one of the first end and the second end extending outward from the socket body.

10. The method of claim 1, wherein the core is removed by chemical etching.

11. The method of claim 1, wherein the core is removed by inserting the socket body into a chemical solvent to dissolve the core.

12. The method of claim 1, wherein the core comprises an aluminum alloy.

13. The method of claim 1, wherein:

the socket cavity in the socket body is one of a plurality of socket cavities in the socket body, each socket cavity comprising an internal surface of a plurality of internal surfaces;

the core is one of a plurality of cores, where the plurality of cores are press fit into the plurality of socket cavities in the socket body, and where there is a one-to-one correspondence between each core of the plurality of cores and each socket cavity of the plurality of socket cavities; and

the plurality of cores are removed from the socket body by inserting the socket body into a chemical solvent to dissolve the plurality of cores; and

the shell layer is one of a plurality of shell layers, where the plurality of shell layers are affixed to the plurality of internal surfaces, and each shell layer comprises a shell cavity of a plurality of shell cavities.

14. The method of claim 13, wherein:

the biasing device is one of a plurality of biasing devices, where the plurality of biasing devices are disposed in the plurality of shell cavities; and

the at least one plunger is one of a plurality of plungers, where the plurality of plungers are disposed in the plurality of shell cavities.

15. The method of claim 1, further comprising at least partially closing an open end of the shell cavity using a retainer to limit sliding movement of at least one of the at least one plunger and the biasing device in the shell cavity.

16. The method of claim 1, wherein the at least one plunger and the biasing device are electrically connected.

17. The method of claim 1, wherein the tail of the at least one plunger is slidably received in the shell cavity with substantially no gap between the tail and the shell.

18. The method of claim 1, wherein:

the shell cavity includes a first end and a second end; and

the at least one plunger includes a first plunger that extends through an opening in the first end of the shell cavity and a second plunger that extends through an opening in the second end of the shell cavity; and

the biasing device biases the tips of the first and second plungers away from the shell cavity.

19. The method of claim 1, wherein the biasing device is a spring.

20. A method of forming an electrical connector, the method comprising:

forming a shell layer in a socket cavity in a socket body such that the shell layer is secured inside the socket cavity by a press fit, the shell layer comprising a shell cavity;

inserting at least one plunger and a biasing device into the shell cavity so that a tail of the at least one plunger is slidably received in the shell cavity and the biasing device biases a tip of the at least one plunger away from the shell cavity; and

at least partially closing an open end of the shell cavity using a retainer to limit sliding movement of at least one of the at least one plunger and the biasing device in the shell cavity.

21. The method of claim 20, further comprising:

affixing at least one layer to a core such that the at least one layer is isomorphic to at least a portion of an external surface of the core;

wherein forming the shell layer in the socket cavity in the socket body includes:

press fitting the core with the at least one layer into the socket cavity in the socket body; and

removing the core from the socket cavity while leaving at least a portion of the layer so that the layer remains in the socket cavity to form the shell layer.

22. The method of claim 21, wherein the core is removed by chemical etching.

23. The method of claim 21, wherein the core is removed by inserting the socket body into a chemical solvent to dissolve the core.

24. The method of claim 21, wherein:
an internal surface of the socket cavity includes a neck portion and a body portion;
an external surface of the core with the at least one layer includes a neck portion and a body portion such that the neck portion of the external surface of the core with the at least one layer is proximal to the neck portion of the internal surface of the socket cavity and the body portion of the external surface of the core with the at least one layer is proximal to the body portion of the internal surface of the socket cavity.

25. The method of claim 20, wherein:
the socket cavity in the socket body is one of a plurality of socket cavities in the socket body; and
the shell layer is one of a plurality of shell layers secured in the plurality of socket cavities, where each shall layer of the plurality of shell layers comprises a shell cavity of a plurality of shell cavities.

26. The method of claim 25, wherein:
the biasing device is one of a plurality of biasing devices, where the plurality of biasing devices are disposed in the plurality of shell cavities; and
the at least one plunger is one of a plurality of plungers, where the plurality of plungers are slidably received in the plurality of shell cavities.

27. The method of claim 20, wherein the at least one plunger and the biasing device are electrically connected.

28. The method of claim 20, wherein the biasing device is a spring.

29. An electrical connector comprising:
a socket shell comprising a body having a socket cavity with an internal socket surface extending through the body, and at least one shell layer having a shell cavity and an external shell surface isomorphic to at least a portion of the internal socket surface and affixed as a layer to at least said portion of the internal socket surface, the at least one shell layer comprising a first shell material; and

a contact probe comprising:

at least one plunger slidably received in the shell cavity and extending through a first opening in a first end of the shell cavity, and

a biasing device configured to exert a biasing force on the at least one plunger.

30. The electrical connector of claim 29, wherein the at least one shell layer is press fit into the socket cavity to affix the at least one shell layer to the portion of the internal socket surface.

31. The electrical connector of claim 29, wherein the first shell material is selected from at least one of: gold and nickel.

32. The electrical connector of claim 29, further comprising:

a retainer contacting the socket shell and configured to limit slidable movement of at least one of: the at least one plunger and the biasing device within the shell cavity.

33. The electrical connector of claim 29, further comprising:

a plurality of contact probes;

wherein the body comprises a plurality of socket cavities, each associated with at least one of the plurality of contact probes.

34. The electrical connector of claim 29, wherein:

the internal socket surface includes a body portion and a neck portion, the neck portion of the internal socket surface having a smaller cross-section than the body portion of the internal socket surface;

the external shell surface includes a body portion and a neck portion, the neck portion of the external shell surface being isomorphic to the neck portion of the internal socket surface, and the body portion of the external shell surface being isomorphic to the body portion of the internal socket surface; and

the body portion of the external shell surface is affixed as a layer to said body portion of the internal socket surface, and the neck portion of the external shell surface is affixed as a layer to said neck portion of the internal socket surface.

35. The electrical connector of claim 34, further comprising.

the internal socket surface includes a shoulder portion connecting the body portion of the internal socket surface and the neck portion of the internal socket surface;

the external shell surface includes a shoulder portion connecting the body portion of the external shell surface and the neck portion of the external shell surface; and

the shoulder portion of the external shell surface is affixed as a layer to said shoulder portion of the internal socket surface.

36. The electrical connector of claim 29, wherein:

the at least one plunger includes a first plunger that extends through the first opening in the first end of the shell cavity and a second plunger that extends through a second opening in a second end of the shell cavity; and

the biasing device is configured to exert the biasing force on the first and second plungers so that the first and second plungers are biased away from each other.

37. The electrical connector of claim 36, wherein:

the electrical connector is an interconnector configured to electrically connect an integrated circuit chip to a printed circuit board via the contact probe;

the first plunger is configured to electrically connect to the integrated circuit chip; and

the second plunger is configured to electrically connect to the printed circuit board.

38. The electrical connector of claim 29, wherein the electrical connector is an interconnector configured to electrically connect an integrated circuit chip to a printed circuit board via the contact probe.

39. The electrical connector of claim 38, wherein the at least one plunger includes a tail that is slidably received in the shell cavity and a tip configured to contact one of the integrated circuit chip and the printed circuit board to form an electrical connection.

40. The electrical connector of claim 29, wherein the biasing device is a spring.

Claims

What is claimed is:

1. An electrical connector comprising:

a socket shell comprising a body having a socket cavity with an internal socket surface extending through the body, and at least one shell layer having a shell cavity and an external shell surface isomorphic to at least a portion of the internal socket surface and affixed as a layer to at least said portion of the internal socket surface, the at least one shell layer comprising a first shell material, the at least one shell layer being press fit into the socket cavity to affix the at least one shell layer to the portion of the internal socket surface; and

a contact probe comprising:

at least one plunger slidably received in the shell cavity and extending through a first opening in a first end of the shell cavity, and

a biasing device configured to exert a biasing force on the at least one plunger.

2. The electrical connector of claim 1, wherein the first shell material is selected from at least one of: gold and nickel.

3. The electrical connector of claim 1, further comprising:

a retainer contacting the socket shell and configured to limit slidable movement of at least one of: the at least one plunger and the biasing device within the shell cavity.

4. The electrical connector of claim 1, further comprising:

a plurality of contact probes;

wherein the body comprises a plurality of socket cavities, each associated with at least one of the plurality of contact probes.

5. The electrical connector of claim 1, wherein:

the internal socket surface includes a body portion and a neck portion, the neck portion of the internal socket surface having a smaller cross-section than the body portion of the internal socket surface;

the external shell surface includes a body portion and a neck portion, the neck portion of the external shell surface being isomorphic to the neck portion of the internal socket surface, and the body

portion of the external shell surface being isomorphic to the body portion of the internal socket surface; and

the body portion of the external shell surface is affixed as a layer to said body portion of the internal socket surface, and the neck portion of the external shell surface is affixed as a layer to said neck portion of the internal socket surface.

6. The electrical connector of claim 5, further comprising,

the internal socket surface includes a shoulder portion connecting the body portion of the internal socket surface and the neck portion of the internal socket surface;

the external shell surface includes a shoulder portion connecting the body portion of the external shell surface and the neck portion of the external shell surface; and

the shoulder portion of the external shell surface is affixed as a layer to said shoulder portion of the internal socket surface.

7. The electrical connector of claim 1, wherein:

the at least one plunger includes a first plunger that extends through the first opening in the first end of the shell cavity and a second plunger that extends through a second opening in a second end of the shell cavity; and

the biasing device is configured to exert the biasing force on the first and second plungers so that the first and second plungers are biased away from each other.

8. The electrical connector of claim 7, wherein:

the electrical connector is an interconnector configured to electrically connect an integrated circuit chip to a printed circuit board via the contact probe;

the first plunger is configured to electrically connect to the integrated circuit chip; and

the second plunger is configured to electrically connect to the printed circuit board.

9. The electrical connector of claim 1, wherein the electrical connector is an interconnector configured to electrically connect an integrated circuit chip to a printed circuit board via the contact probe.

10. The electrical connector of claim 9, wherein the at least one plunger includes a tail that is slidably received in the shell cavity and a tip configured to contact one of the integrated circuit chip and the printed circuit board to form an electrical connection.

11. The electrical connector of claim 1, wherein the biasing device is a spring.

12. The electrical connector of claim 1, wherein the at least one plunger including a tail slidably received in and contacting the at least one shell layer.

13. The electrical connector of claim 1, wherein the at least one shell layer includes:

a first layer formed of the first shell material, the first layer being isomorphic to at least the portion of the internal socket surface and affixed as a layer to at least the portion of the internal socket surface; and

a second layer formed of a second shell material and contacting an internal surface of the first layer, the second shell material being different from the first shell material.

14. The electrical connector of claim 1, wherein the at least one shell layer has a substantially constant cross-section along a length of the socket cavity.

15. The electrical connector of claim 4, wherein each contact probe provides an electrical connection between an integrated circuit chip and a printed circuit board that is separate from the electrical connections between the integrated circuit chip and the printed circuit board provided by other contact probes.

16. An electrical connector comprising:

a socket shell comprising a body having a socket cavity with an internal socket surface extending through the body, and at least one shell layer having a shell cavity and an external shell surface isomorphic to at least a portion of the internal socket surface and affixed as a layer to at least said portion of the internal socket surface, the at least one shell layer comprising a first shell material; and

a contact probe comprising:

at least one plunger slidably received in the shell cavity and extending through a first opening in a first end of the shell cavity, the at least one plunger including a tail slidably received in and contacting the at least one shell layer, and

a biasing device configured to exert a biasing force on the at least one plunger.

17. The electrical connector of claim 16, further comprising:

a retainer contacting the socket shell and configured to limit slidable movement of the at least one plunger, the biasing device being configured to exert the biasing force on the at least one plunger to position the tail of the at least one plunger so that the tail contacts the retainer and the at least one shell layer.

18. A method of forming an electrical connector, the method comprising:

affixing at least one layer to a core such that the at least one layer is isomorphic to at least a portion of an external surface of the core;

inserting the core with the at least one layer into a socket cavity in a socket body of a socket shell, where the socket cavity comprises an internal socket surface extending through the body;

removing the core from the socket cavity while leaving at least a portion of the at least one layer so that the at least one layer forms at least one shell layer affixed to the internal socket surface of the socket cavity, the at least one shell layer further comprising a shell cavity with an external shell surface isomorphic to at least a portion of the internal socket surface and affixed as a layer to at least the portion of the internal socket surface, the at least one shell layer comprising a first shell material; and

inserting at least one plunger and a biasing device into the shell cavity so that the at least one plunger is slidably received in the shell cavity and extends through a first opening in a first end of the shell cavity, so that the biasing device exerts a biasing force on the at least one plunger, and so that a tail of the at least one plunger is slidably received in and contacts the at least one shell layer, the at least one plunger and the biasing device forming a contact probe.

19. The method of claim 18, further comprising at least partially closing an open end of the shell cavity using a retainer to limit sliding movement of at least one of the at least one plunger and the biasing device in the shell cavity, the retainer contacting the socket shell and limiting slidable movement of the at least one plunger, the biasing device being configured to exert the biasing force on the at least one plunger to position the tail of the at least one plunger so that the tail contacts the retainer and the at least one shell layer.