CLAIMS

We claim:

1. A method for processing a semiconductor substrate, comprising:

forming an aperture in a semiconductor substrate and through a dielectric on the semiconductor substrate, the aperture having a first end open at the dielectric and a second end in the semiconductor substrate;

forming a plurality of depressions in the dielectric; and

simultaneously depositing a conductive material into the aperture and at least some of the plurality of depressions;

exposing the conductive material at the second end of the aperture; and

attaching a solder ball to the exposed conductive material at the second end of the aperture.

2. The method of claim 1 wherein

the semiconductor substrate has a first substrate surface and a second substrate surface;

the dielectric has a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface;

forming the aperture includes forming an aperture open at the first dielectric surface and extends through the dielectric and into the semiconductor substrate, the aperture having a depth of at least 50 microns from the first dielectric surface and an aspect ratio of at least 5:1;

forming the plurality of depressions includes forming a plurality of depressions that extend into the dielectric from the first dielectric surface, the plurality of depressions having a depth of about 0.3 to about 0.5 microns from the first dielectric surface;

simultaneously depositing the conductive material includes depositing the conductive material into the aperture and in at least some of the plurality of depressions, the conductive material having a first portion in the aperture, a second portion in the depressions, and a third portion extending beyond the first dielectric surface; and

the method further includes removing at least the third portion of the conductive material via chemical-mechanical polishing and/or electrochemical-mechanical polishing.

3. The method of claim 1 wherein

the semiconductor substrate has a first substrate surface and a second substrate surface;

the dielectric has a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface;

forming the aperture includes forming an aperture open at the first dielectric surface and extends through the dielectric and into the semiconductor substrate, the aperture having a depth of at least 50 microns from the first dielectric surface and an aspect ratio of at least 5:1;

forming the plurality of depressions includes forming a plurality of depressions that extend into the dielectric from the first dielectric surface, the plurality of depressions having a depth of about 0.3 to about 0.5 microns from the first dielectric surface;

simultaneously depositing the conductive material includes plating copper into the aperture and in at least some of the plurality of depressions, the copper having a first portion in the aperture, a second portion in the depressions, and a third portion extending beyond the first dielectric surface; and

the method further includes removing at least the third portion of the introduced copper via chemical-mechanical polishing and/or electrochemical-mechanical polishing.

4. The method of claim 1 wherein forming the aperture includes forming the aperture before forming the plurality of depressions.

5. The method of claim 1 wherein forming the aperture includes forming the aperture after forming the plurality of depressions.

6. The method of claim 1 wherein

the semiconductor substrate has a first substrate surface and a second substrate surface;

the dielectric has a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface;

forming the plurality of depressions includes forming at least one depression open to the aperture;

simultaneously depositing the conductive material includes depositing the conductive material into the aperture and the at least one depression, the introduced conductive material having a first portion in the aperture and a second portion in the at least one depression; and

the first and second portions of the conductive material are generally homogeneous.

7. The method of claim 1 wherein

the semiconductor substrate has a first substrate surface and a second substrate surface;

the dielectric has a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface;

forming the plurality of depressions includes forming at least one depression open to the aperture;

simultaneously depositing the conductive material includes depositing the conductive material into the aperture and the at least one depression, the introduced conductive material having a first portion in the aperture and a second portion in the at least one depression; and

the first and second portions of the conductive material are generally contiguous.

8. The method of claim 1 wherein

the semiconductor substrate has a first substrate surface and a second substrate surface;

the dielectric has a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface;

forming the plurality of depressions includes forming at least one depression open to the aperture;

simultaneously depositing the conductive material includes depositing the conductive material into the aperture and the at least one depression, the introduced conductive material having a first portion in the aperture and a second portion in the at least one depression; and

the first and second portions of the conductive material do not include a physical boundary between each other.

9. The method of claim 1 wherein

the semiconductor substrate has a first substrate surface and a second substrate surface;

the dielectric has a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface;

the method further includes forming an interconnect structure open to both at least one of the depressions and the aperture;

simultaneously depositing the conductive material includes depositing the conductive material into the aperture, the at least one depression, and the interconnect structure, the introduced conductive material having a first portion in the aperture, a second portion in the at least one depression, and a third portion in the interconnect structure; and

the first, second, and third portions of the conductive material do not include a physical boundary between one another.

10. The method of claim 1 wherein

the semiconductor substrate has a first substrate surface and a second substrate surface;

the dielectric has a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface;

the method further includes forming an interconnect structure open to both at least one of the depressions and the aperture;

simultaneously depositing the conductive material includes depositing the conductive material into the aperture, the at least one depression, and the interconnect structure, the introduced conductive material having a first portion in the aperture, a second portion in the at least one depression, and a third portion in the interconnect structure; and

the first, second, and third portions of the conductive material are contiguous.

11. The method of claim 1 wherein

the semiconductor substrate has a first substrate surface and a second substrate surface;

the dielectric has a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface;

simultaneously depositing the conductive material includes depositing the conductive material into the aperture and at least some of the plurality of depressions, the introduced conductive material having a first portion in the aperture, a second portion in the depressions, and a third portion extending beyond the first dielectric surface; and

the method further includes:

polishing the semiconductor substrate; and

removing the third portion of the introduced conductive material until the first dielectric surface is exposed.

12. The method of claim 1 wherein

the semiconductor substrate has a first substrate surface and a second substrate surface;

the dielectric has a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface;

simultaneously depositing the conductive material includes simultaneously depositing the conductive material into the aperture and at least some of the plurality of depressions, the introduced conductive material having a first portion in the aperture, a second portion in the depressions, and a third portion extending beyond the first dielectric surface; and

the method further includes:

polishing the semiconductor substrate;

removing the third portion of the introduced conductive material until the first dielectric surface is exposed; and

reducing a risk of dishing the first portion of the conductive material in the aperture.

13. A method for processing a semiconductor wafer, the semiconductor wafer including a substrate with a first substrate surface and a second substrate surface, the semiconductor wafer also including a dielectric with a first dielectric surface and a second dielectric surface in direct contact with the first substrate surface, the method comprising:

forming an aperture having an open end at the first dielectric surface and a closed end in the substrate toward the second substrate surface;

forming a depression in the dielectric, the depression extending between the first dielectric surface and the second dielectric surface;

filling the depression and at least a portion of the aperture with a conductive material in a single processing stage; and

removing material from the second substrate surface of the substrate and thereby exposing a portion of the conductive material proximate the closed end of the aperture.

14. The method of claim 13 wherein forming the aperture includes:

patterning the semiconductor wafer with a first photoresist material;

removing material from the patterned semiconductor wafer;

removing the first photoresist material; and

depositing an insulation material in the aperture and on the first dielectric surface of the dielectric.

15. The method of claim 13 wherein:

forming the aperture includes depositing an insulation material on the semiconductor wafer, the insulation material having a first portion in the aperture and a second portion on the first dielectric surface of the dielectric.

16. The method of claim 13 wherein forming the depression includes forming a depression that extends into the dielectric from the first dielectric surface to a depth of about 0.3 to about 0.5 microns from the first dielectric surface.

17. The method of claim 13 wherein filling the depression and the aperture with the conductive material includes plating the conductive material into the depression and the aperture without intervening processing stages.

18. The method of claim 13 wherein:

filling the depression and the aperture with the conductive material includes plating the conductive material into the depression and the aperture without intervening processing stages, the conductive material including a portion extending beyond the first dielectric surface; and

removing the portion of the conductive material that extends beyond the first dielectric surface.

19. The method of claim 13, further comprising attaching a solder ball to the exposed conductive material proximate the closed end of the aperture.

20. A device, comprising:

a semiconductor substrate having a first substrate surface and a second substrate surface;

a dielectric on the semiconductor substrate, the dielectric having a first dielectric surface and a second dielectric surface, wherein the second dielectric surface is in direct contact with the first substrate surface;

a depression in the dielectric;

an aperture through the dielectric and at least a portion of the semiconductor substrate; and

a conductive material having a first portion in the depression and a second portion in the aperture, wherein the first and second portions of the conductive material are formed in one single processing stage such that a sacrificial portion of the conductive material extends between the first and second portions.

21. The device of claim 20 wherein:

the depression extends between the first dielectric surface and the second dielectric surface;

the aperture extends from the first dielectric surface to the second substrate surface; and

the first and second portions of the conductive material are generally homogeneous.

CLAIMS

We claim:

1. A device, comprising:

a semiconductor substrate having a first substrate surface and a second substrate surface;

a dielectric on the semiconductor substrate, the dielectric having a first dielectric surface and a second dielectric surface, wherein the second dielectric surface is in direct contact with the first substrate surface;

a depression in the dielectric;

an aperture through the dielectric and at least a portion of the semiconductor substrate; and

a conductive material having a first portion in the depression and a second portion in the aperture, wherein the first and second portions of the conductive material are formed in one single processing stage such that a sacrificial portion of the conductive material extends between the first and second portions.

2. The device of claim 1 wherein:

the depression extends between the first dielectric surface and the second dielectric surface;

the aperture extends from the first dielectric surface to the second substrate surface; and

the first and second portions of the conductive material are generally homogeneous.