

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

an insulator including a projection;

an island-shaped semiconductor over the insulator including the projection;

a first electrode and a second electrode;

a first insulator;

a second insulator; and

a third electrode,

wherein the first electrode and the second electrode are on and in contact with the island-shaped semiconductor,

wherein the first insulator is over the island-shaped semiconductor, the first electrode, and the second electrode,

wherein the first insulator comprises an opening or a groove overlapping with the island-shaped semiconductor,

wherein the second insulator covers an inner wall of the opening or the groove, and an exposed portion of the island-shaped semiconductor,

wherein a cross-section view of the semiconductor device taken along a direction defined by a straight line joining the first and the second electrodes shows that the third electrode overlaps with and fills the opening or the groove, the second insulator being interposed between the third electrode and each of the island-shaped semiconductor, the first electrode, and the second electrode,

wherein the first insulator covers and faces both of a side surface and a top surface of a peripheral edge of the first electrode,

wherein the island-shaped semiconductor is in contact with the projection,
wherein the first insulator is in contact with a side surface of the projection,
wherein an entire bottom surface of the island-shaped semiconductor overlaps a
top surface of the projection, and

wherein the side surface of the projection and a side surface of the island-shaped
semiconductor are aligned.

2. The semiconductor device according to claim 1, wherein the island-shaped
semiconductor is an oxide semiconductor.

3. The semiconductor device according to claim 1, wherein the second insulator
covers a top surface region of the first insulator.

4. The semiconductor device according to claim 1, wherein a top surface of the
third electrode is planarized.

5. The semiconductor device according to claim 1, wherein the first insulator is
on and in direct contact with the first electrode.

6. A method for manufacturing a semiconductor device, the method comprising:
forming a patterned semiconductor over an insulator including a projection;
forming a first electrode and a second electrode on and in contact with the
patterned semiconductor;

forming a first insulator over the patterned semiconductor, the first electrode,

and the second electrode;

forming an opening or a groove in the first insulator, the opening or the groove overlapping with the patterned semiconductor;

forming a second insulator covering an inner wall of the opening or the groove and an exposed portion of the patterned semiconductor; and

forming a third electrode in the opening or the groove, the second insulator being interposed between the third electrode and each of the patterned semiconductor, the first electrode, and the second electrode, and

a cross-section view of the semiconductor device taken along a direction defined by a straight line joining the first and the second electrodes shows that the third electrode overlaps with the opening or the groove,

wherein the first insulator covers and faces both of a side surface and a top surface of a peripheral edge of the first electrode,

wherein the patterned semiconductor is in contact with the projection,

wherein the first insulator is in contact with a side surface of the projection,

wherein an entire bottom surface of the patterned semiconductor overlaps a top surface of the projection, and

wherein the side surface of the projection and a side surface of the patterned semiconductor are aligned.

7. The method for manufacturing a semiconductor device according to claim 6, the method comprising:

a first step of forming a semiconductor;

a second step of performing a first process on the semiconductor so as to form

the patterned semiconductor, the patterned semiconductor being an island-shaped semiconductor;

a third step of forming a first conductor over the island-shaped semiconductor;

a fourth step of performing a second process on the first conductor so as to form a conductor having a first pattern;

a fifth step of forming the first insulator over the conductor having the first pattern;

a sixth step of forming the opening or the groove in the first insulator;

a seventh step of performing a third process on the conductor having the first pattern in the opening or the groove so as to form the first electrode and the second electrode and to expose the island-shaped semiconductor;

an eighth step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the island-shaped semiconductor;

a ninth step of forming a second conductor over the second insulator; and

a tenth step of performing a fourth process on the second conductor so as to form the third electrode.

8. The method for manufacturing a semiconductor device according to claim 6, the method comprising:

a first step of forming a semiconductor;

a second step of performing a first process on the semiconductor so as to form the patterned semiconductor, the patterned semiconductor being an island-shaped semiconductor;

a third step of forming a first conductor over the island-shaped semiconductor;

a fourth step of forming the first insulator over the first conductor;

a fifth step of performing a second process on the first insulator so that the first insulator has a desired pattern, and performing a third process on the first conductor so as to form the first electrode and the second electrode and to expose the island-shaped semiconductor;

a sixth step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the island-shaped semiconductor;

a seventh step of forming a second conductor over the second insulator; and

an eighth step of performing a fourth process on the second conductor so as to form the third electrode,

wherein the opening or the groove is formed by the second process and the third process.

9. The method for manufacturing a semiconductor device according to claim 6, the method comprising:

a first step of forming a semiconductor;

a second step of forming a first conductor on and in contact with the semiconductor;

a third step of performing a first process on the semiconductor and the first conductor so as to form a semiconductor and a conductor each having a first pattern, whereby the patterned semiconductor is formed;

a fourth step of forming the first insulator over the semiconductor and the

conductor each having the first pattern;

a fifth step of forming the opening or the groove in the first insulator;

a sixth step of performing a second process on the conductor having the first pattern in the opening or the groove so as to form the first electrode and the second electrode and to expose a portion of the patterned semiconductor;

a seventh step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the patterned semiconductor;

an eighth step of forming a second conductor over the second insulator; and

a ninth step of performing a third process on the second conductor so as to form the third electrode.

10. The method for manufacturing a semiconductor device according to claim 6, the method comprising:

a first step of forming a semiconductor;

a second step of forming a first conductor on and in contact with the semiconductor;

a third step of forming the first insulator over the first conductor;

a fourth step of performing a first process on the first insulator, on the first conductor, and on the semiconductor so that the first insulator, the first conductor, and the semiconductor have a desired pattern, whereby forming the patterned semiconductor;

a fifth step of performing a second process on the first insulator and on the first conductor so as to form the first electrode and the second electrode and to expose a

portion of the patterned semiconductor;

a sixth step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the patterned semiconductor;

a seventh step of forming a second conductor over the second insulator; and

an eighth step of performing a third process on the second conductor so as to form the third electrode,

wherein the opening or the groove is formed by the second process.

11. The method for manufacturing a semiconductor device according to claim 6, wherein the first insulator is an insulator having planarity.

12. The method for manufacturing a semiconductor device according to claim 6, wherein the first insulator includes a low-dielectric constant material.

13. The method for manufacturing a semiconductor device according to claim 7, wherein the second conductor is processed using CMP treatment.

14. The method for manufacturing a semiconductor device according to claim 8, wherein the second conductor is processed using CMP treatment.

15. The method for manufacturing a semiconductor device according to claim 9, wherein the second conductor is processed using CMP treatment.

16. The method for manufacturing a semiconductor device according to claim 6,

wherein the patterned semiconductor is an oxide semiconductor.

17. The method for manufacturing a semiconductor device according to claim 6, wherein the second insulator covers a top surface region of the first insulator.

18. The method for manufacturing a semiconductor device according to claim 6, wherein a top surface of the third electrode is planarized.

19. The method for manufacturing a semiconductor device according to claim 6, wherein the first insulator is formed on and in direct contact with the patterned semiconductor, the first electrode, and the second electrode.

20. A semiconductor device comprising:

an insulator including a projection;

an island-shaped semiconductor over the insulator including the projection;

a first electrode and a second electrode;

a first insulator;

a second insulator; and

a third electrode,

wherein the first electrode and the second electrode are on and in contact with the island-shaped semiconductor,

wherein the first insulator is over the island-shaped semiconductor, the first electrode, and the second electrode,

wherein the first insulator comprises an opening or a groove overlapping with

the island-shaped semiconductor,

wherein the second insulator is over the first insulator, an inner wall of the opening or the groove, and an exposed portion of the island-shaped semiconductor,

wherein a cross-section view of the semiconductor device taken along a direction defined by a straight line joining the first and the second electrodes shows that the third electrode overlaps with and fills the opening or the groove, the second insulator being interposed between the third electrode and each of the island-shaped semiconductor, the first electrode, and the second electrode,

wherein the first insulator covers and faces both of a side surface and a top surface of a peripheral edge of the first electrode,

wherein the island-shaped semiconductor is in contact with the projection,

wherein the first insulator is in contact with a side surface of the projection,

wherein an entire bottom surface of the island-shaped semiconductor overlaps a top surface of the projection,

wherein the side surface of the projection and a side surface of the island-shaped semiconductor are aligned, and

wherein the side surface of the island-shaped semiconductor and the side surface of the peripheral edge of the first electrode are aligned.

21. The semiconductor device according to claim 20, wherein a top surface of the first insulator is at a constant height.

22. The semiconductor device according to claim 20, wherein the island-shaped semiconductor is an oxide semiconductor.

23. The semiconductor device according to claim 20, wherein the second insulator covers a top surface region of the first insulator.

24. The semiconductor device according to claim 20, wherein a top surface of the third electrode is planarized.

25. The semiconductor device according to claim 20, wherein the first insulator is on and in direct contact with the first electrode.

26. A method for manufacturing a semiconductor device, the method comprising:

a first step of forming a semiconductor over an insulator including a projection;

a second step of forming a first conductor on and in contact with the semiconductor;

a third step of performing a first process on the semiconductor and the first conductor so as to form a semiconductor and a conductor each having a first pattern, whereby a patterned semiconductor is formed;

a fourth step of forming a first insulator over the semiconductor and the conductor each having the first pattern, the first insulator having planarity;

a fifth step of forming an opening or a groove in the first insulator;

a sixth step of performing a second process on the conductor having the first pattern in the opening or the groove so as to form a first electrode and a second electrode and to expose a portion of the patterned semiconductor;

a seventh step of forming a second insulator covering an inner wall of the

opening or the groove, and the exposed portion of the patterned semiconductor;

an eighth step of forming a second conductor over the second insulator; and

a ninth step of performing a third process on the second conductor so as to form a third electrode, the third process being a chemical mechanical polishing process,

wherein a cross-section view of the semiconductor device taken along a direction defined by a straight line joining the first and the second electrodes shows that the third electrode overlaps with the opening or the groove, and

wherein the first insulator covers and faces both of a side surface and a top surface of a peripheral edge of the first electrode,

wherein the patterned semiconductor is in contact with the projection,

wherein the first insulator is in contact with a side surface of the projection,

wherein an entire bottom surface of the patterned semiconductor overlaps a top surface of the projection, and

wherein the side surface of the projection and a side surface of the patterned semiconductor are aligned.

27. The method for manufacturing a semiconductor device according to claim 26, wherein the patterned semiconductor is an oxide semiconductor.

28. The method for manufacturing a semiconductor device according to claim 26, wherein the second insulator covers a top surface region of the first insulator.

29. The method for manufacturing a semiconductor device according to claim 26, wherein a top surface of the third electrode is planarized.

30. The method for manufacturing a semiconductor device according to claim 26, wherein the first insulator is formed on and in direct contact with the semiconductor and the conductor.