Claims

1. A memcapacitor device, comprising:

a pair of opposing conductive electrodes; and

a semiconductive material comprising multiple different types of mobile dopants within a dielectric and a mobile dopant barrier dielectric material received between the pair of opposing conductive electrodes, the semiconductive material and the barrier dielectric material being of different composition relative one another which is at least characterized by at least one different atomic element, one of the semiconductive material and the barrier dielectric material being closer to one of the pair of electrodes than is the other of the semiconductive material and the barrier dielectric material, the other of the semiconductive material and the barrier dielectric material being closer to the other of the pair of electrodes than is the one of the semiconductive material and the barrier dielectric material.

2. The device of claim 1 wherein the different types comprises atom vacancy and atom interstitial.

3. The device of claim 1 wherein the mobile dopant barrier dielectric material is no thicker than the semiconductive material that comprises mobile dopants within a dielectric.

4. The device of claim 3 wherein the semiconductive material that comprises mobile dopants within a dielectric is thicker than the mobile dopant barrier dielectric material.

5. The device of claim 1 wherein the mobile dopant barrier dielectric material has an equivalent oxide thickness no greater than 10 nanometers.

6. A memcapacitor device, comprising:

a pair of opposing conductive electrodes; and

a semiconductive material comprising mobile dopants within a dielectric and a mobile dopant barrier dielectric material received between the pair of opposing conductive electrodes, the dielectric within which are the mobile dopants being non-homogenous independent of consideration of the mobile dopants, the semiconductive material and the barrier dielectric material being of different composition relative one another which is at least characterized by at least one different atomic element, one of the semiconductive material and the barrier dielectric material being closer to one of the pair of electrodes than is the other of the semiconductive material and the barrier dielectric material, the other of the semiconductive material and the barrier dielectric material being closer to the other of the pair of electrodes than is the one of the semiconductive material and the barrier dielectric material.

7. A memcapacitor device, comprising:

a pair of opposing conductive electrodes; and

a semiconductive material comprising mobile dopants within a dielectric and a mobile dopant barrier dielectric material received between the pair of opposing conductive electrodes, the barrier dielectric material being non-homogenous, the semiconductive material and the barrier dielectric material being of different composition relative one another which is at least characterized by at least one different atomic element, one of the semiconductive material and the barrier dielectric material being closer to one of the pair of electrodes than is the other of the semiconductive material and the barrier dielectric material, the other of the semiconductive material and the barrier dielectric material being closer to the other of the pair of electrodes than is the one of the semiconductive material and the barrier dielectric material.

8. A field effect transistor device capable of being repeatedly programmed to at least two different static threshold voltage states, comprising:

a pair of source/drain regions, a channel region between the pair of source/drain regions, and a gate construction operably proximate the channel region;

the gate construction comprising a conductive gate electrode and comprising a semiconductive material comprising mobile dopants within a dielectric and comprising a mobile dopant barrier dielectric material received between the conductive gate electrode and the channel region, the mobile dopant barrier dielectric material being closer to the channel region than to the conductive gate electrode, the semiconductive material that comprises mobile dopants within a dielectric being closer to the conductive gate electrode than to the channel region; and

at least one of:

the semiconductive material comprising multiple different types of mobile dopants within the dielectric;

the dielectric within which are the mobile dopants being non-homogenous independent of consideration of the mobile dopants; and

the barrier dielectric material being non-homogenous.

9. The device of claim 8 wherein the semiconductive material comprises multiple different types of mobile dopants within the dielectric.

10. The device of claim 8 wherein the dielectric within which are the mobile dopants is non-homogenous independent of consideration of the mobile dopants.

11. The device of claim 8 wherein the barrier dielectric is non-homogenous.

12. The device of claim 8 wherein the mobile dopant barrier dielectric material is no thicker than the semiconductive material that comprises mobile dopants within a dielectric.

13. The device of claim 12 wherein the semiconductive material that comprises mobile dopants within a dielectric is thicker than the mobile dopant barrier dielectric material.

14. The device of claim 8 wherein the mobile dopant barrier dielectric material has an equivalent oxide thickness from 1 nanometer to 12 nanometers.

15. The device of claim 14 wherein the mobile dopant barrier dielectric material has an equivalent oxide thickness no greater than 7 nanometers.

16. A non-volatile memory array comprising:

a plurality of word lines;

a plurality of bit lines;

a plurality of memory cells, individual of the memory cells comprising a field effect transistor device capable of being repeatedly programmed to at least two different static threshold voltage states, the field effect transistor device comprising:

a pair of source/drain regions, a channel region between the pair of source/drain regions, and a gate construction operably proximate the channel region; and

the gate construction comprising a conductive gate electrode and comprising a semiconductive material comprising mobile dopants within a dielectric and comprising a mobile dopant barrier dielectric material received between the conductive gate electrode and the channel region, the mobile dopant barrier dielectric material being closer to the channel region than to the conductive gate electrode, the semiconductive material that comprises mobile dopants within a dielectric being closer to the conductive gate electrode than to the channel region;

the conductive gate electrode connecting to one of the word lines;

one of the pair of source/drain regions connecting with one of the bit lines; and

at least one of:

the semiconductive material comprising multiple different types of mobile dopants within the dielectric;

the dielectric within which are the mobile dopants being non-homogenous independent of consideration of the mobile dopants; and

the barrier dielectric material being non-homogenous.

17. The array of claim 16 wherein the semiconductive material comprises multiple different types of mobile dopants within the dielectric.

18. The array of claim 16 wherein the dielectric within which are the mobile dopants is non-homogenous independent of consideration of the mobile dopants.

19. The array of claim 16 wherein the barrier dielectric is non-homogenous.

20. The array of claim 16 wherein the one of the pair of source/drain regions is indirectly connected with the one of the bit lines via one or more of the other memory cells.

21. The array of claim 16 further comprising circuitry configured to enable a current to flow through the pair of source/drain regions, the channel region, and the one of the bit lines when a voltage is applied to the one of the word lines.

22. The array of claim 21 wherein the one of the pair of source/drain regions is indirectly connected with the one of the bit lines via one or more of the other memory cells.

The invention claimed is:

1. A memcapacitor device, comprising:

a pair of opposing conductive electrodes; and

a semiconductive material comprising multiple different types of mobile dopants within a dielectric and a mobile dopant barrier dielectric material received between the pair of opposing conductive electrodes, the semiconductive material and the barrier dielectric material being of different composition relative one another which is at least characterized by at least one different atomic element, one of the semiconductive material and the barrier dielectric material being closer to one of the pair of electrodes than is the other of the semiconductive material and the barrier dielectric material, the other of the semiconductive material and the barrier dielectric material being closer to the other of the pair of electrodes than is the one of the semiconductive material and the barrier dielectric material.

2. The device of claim 1 wherein the different types comprises atom vacancy and atom interstitial.

3. The device of claim 1 wherein the mobile dopant barrier dielectric material is no thicker than the semiconductive material that comprises mobile dopants within a dielectric.

4. The device of claim 3 wherein the semiconductive material that comprises mobile dopants within a dielectric is thicker than the mobile dopant barrier dielectric material.

5. The device of claim 1 wherein the mobile dopant barrier dielectric material has an equivalent oxide thickness no greater than 10 nanometers.

6. A memcapacitor device, comprising:

a pair of opposing conductive electrodes; and

a semiconductive material comprising mobile dopants within a dielectric and a mobile dopant barrier dielectric material received between the pair of opposing conductive electrodes, the dielectric within which are the mobile dopants being non-homogenous independent of consideration of the mobile dopants, the semiconductive material and the barrier dielectric material being of different composition relative one another which is at least characterized by at least one different atomic element, one of the semiconductive material and the barrier dielectric material being closer to one of the pair of electrodes than is the other of the semiconductive material and the barrier dielectric material, the other of the semiconductive material and the barrier dielectric material being closer to the other of the pair of electrodes than is the one of the semiconductive material and the barrier dielectric material.

7. A memcapacitor device, comprising:

a pair of opposing conductive electrodes; and

a semiconductive material comprising mobile dopants within a dielectric and a mobile dopant barrier dielectric material received between the pair of opposing conductive electrodes, the barrier dielectric material being non-homogenous, the semiconductive material and the barrier dielectric material being of different composition relative one another which is at least characterized by at least one different atomic element, one of the semiconductive material and the barrier dielectric material being closer to one of the pair of electrodes than is the other of the semiconductive material and the barrier dielectric material, the other of the semiconductive material and the barrier dielectric material being closer to the other of the pair of electrodes than is the one of the semiconductive material and the barrier dielectric material.

8. A field effect transistor device capable of being repeatedly programmed to at least two different static threshold voltage states, comprising:

a pair of source/drain regions, a channel region between the pair of source/drain regions, and a gate construction operably proximate the channel region;

the gate construction comprising a conductive gate electrode and comprising a semiconductive material comprising mobile dopants within a dielectric and comprising a mobile dopant barrier dielectric material received between the conductive gate electrode and the channel region, the mobile dopant barrier dielectric material being closer to the channel region than to the conductive gate electrode, the semiconductive material that comprises mobile dopants within a dielectric being closer to the conductive gate electrode than to the channel region; and

at least one of: the semiconductive material comprising multiple different types of mobile dopants within the dielectric;

the dielectric within which are the mobile dopants being non-homogenous independent of consideration of the mobile dopants; and

the barrier dielectric material being non-homogenous.

9. The device of claim 8 wherein the semiconductive material comprises multiple different types of mobile dopants within the dielectric.

10. The device of claim 8 wherein the dielectric within which are the mobile dopants is non-homogenous independent of consideration of the mobile dopants.

11. The device of claim 8 wherein the barrier dielectric is non-homogenous.

12. The device of claim 8 wherein the mobile dopant barrier dielectric material is no thicker than the semiconductive material that comprises mobile dopants within a dielectric.

13. The device of claim 12 wherein the semiconductive material that comprises mobile dopants within a dielectric is thicker than the mobile dopant barrier dielectric material.

14. The device of claim 8 wherein the mobile dopant barrier dielectric material has an equivalent oxide thickness from 1 nanometer to 12 nanometers.

15. The device of claim 14 wherein the mobile dopant barrier dielectric material has an equivalent oxide thickness no greater than 7 nanometers.

16. A non-volatile memory array comprising:

a plurality of word lines;

a plurality of bit lines;

a plurality of memory cells, individual of the memory cells comprising a field effect transistor device capable of being repeatedly programmed to at least two different static threshold voltage states, the field effect transistor device comprising:

a pair of source/drain regions, a channel region between the pair of source/drain regions, and a gate construction operably proximate the channel region; and

the gate construction comprising a conductive gate electrode and comprising a semiconductive material comprising mobile dopants within a dielectric and comprising a mobile dopant barrier dielectric material received between the conductive gate electrode and the channel region, the mobile dopant barrier dielectric material being closer to the channel region than to the conductive gate electrode, the semiconductive material that comprises mobile dopants within a dielectric being closer to the conductive gate electrode than to the channel region;

the conductive gate electrode connecting to one of the word lines;

one of the pair of source/drain regions connecting with one of the bit lines; and

at least one of:

the semiconductive material comprising multiple different types of mobile dopants within the dielectric; the dielectric within which are the mobile dopants being non-homogenous independent of consideration of the mobile dopants; and

the barrier dielectric material being non-homogenous.

17. The array of claim 16 wherein the semiconductive material comprises multiple different types of mobile dopants within the dielectric.

18. The array of claim 16 wherein the dielectric within which are the mobile dopants is non-homogenous independent of consideration of the mobile dopants.

19. The array of claim 16 wherein the barrier dielectric is non-homogenous.

20. The array of claim 16 wherein the one of the pair of source/drain regions is indirectly connected with the one of the bit lines via one or more of the other memory cells.

21. The array of claim 16 further comprising circuitry configured to enable a current to flow through the pair of source/drain regions, the channel region, and the one of the bit lines when a voltage is applied to the one of the word lines.

22. The array of claim 21 wherein the one of the pair of source/drain regions is indirectly connected with the one of the bit lines via one or more of the other memory cells.