CLAIMS

1. A semiconductor processing method comprising:

providing a silicon-containing precursor to a processing region of a semiconductor processing chamber, wherein a substrate is disposed within the processing region of the semiconductor processing chamber;

forming a plasma of the silicon-containing precursor in the processing region;

forming a first layer of material on the substrate, wherein the first layer of material comprises silicon oxide;

providing a germanium-containing precursor to the processing region of the semiconductor processing chamber;

forming a plasma of the germanium-containing precursor in the processing region; and

forming a second layer of material on the substrate, wherein the second layer of material comprises germanium oxide.

2. The semiconductor processing method of claim 1, wherein a temperature within the semiconductor processing chamber is maintained at less than or equal to 550 °C while forming the first layer of material and the second layer of material on the substrate.

3. The semiconductor processing method of claim 1, wherein a pressure within the semiconductor processing chamber is maintained at less than or equal to 6 Torr while forming the first layer of material and the second layer of material on the substrate.

4. The semiconductor processing method of claim 1, wherein forming the plasma of the silicon-containing precursor is performed at a plasma power of less than or equal to 500 W.

5. The semiconductor processing method of claim 1, wherein forming the plasma of the germanium-containing precursor is performed at a plasma power of greater than or equal to 900 W.

6. The semiconductor processing method of claim 1, wherein an atomic ratio of germanium to oxygen in the second layer of material is less than or equal to 1:2.

7. The semiconductor processing method of claim 1, where each layer of material has a thickness between 10 nm and 30 nm.

8. The semiconductor processing method of claim 1, further comprising:

forming alternating sets of the first layer of material and the second layer of material on the substrate.

9. The semiconductor processing method of claim 8, further comprising:

annealing the substrate subsequent forming alternating sets of the first layer of material and the second layer of material.

10. A semiconductor processing method comprising:

forming a first layer of material on a substrate in a processing region of a semiconductor processing chamber, wherein the first layer of material comprises silicon oxide,

forming a second layer of material on the substrate, wherein the second layer of material comprises germanium oxide, and wherein an atomic ratio of germanium to oxygen in the second layer of material is less than or equal to 3:2; and

annealing the substrate subsequent forming the first layer and the second layer on the substrate.

11. The semiconductor processing method of claim 10, wherein a temperature within the semiconductor processing chamber is maintained at less than or equal to 550 °C while forming the first layer of material and the second layer of material on the substrate.

12. The semiconductor processing method of claim 10, wherein a pressure within the semiconductor processing chamber is maintained at less than or equal to 6 Torr while forming the first layer of material and the second layer of material on the substrate.

13. The semiconductor processing method of claim 10, wherein the atomic ratio of germanium to oxygen in the second layer of material is less than or equal to 2:3.

14. The semiconductor processing method of claim 10, further comprising:

forming a plasma of a germanium-containing precursor in the processing region prior to forming the second layer of material on the substrate, wherein forming the plasma of the germanium-containing precursor is performed at a plasma power of greater than or equal to 900 W.

15. The semiconductor processing method of claim 10, further comprising:

forming alternating sets of the first layer of material and the second layer of material on the substrate, wherein the alternating sets of the first layer of material and the second layer of material comprise at least 50 layers of alternating layers of silicon oxide and germanium oxide.

16. A semiconductor processing method comprising:

providing a silicon-containing precursor and an oxygen-containing precursor to a processing region of a semiconductor processing chamber, wherein a substrate is disposed within the processing region of the semiconductor processing chamber;

forming a plasma of the silicon-containing precursor and the oxygen-containing precursor in the processing region;

forming a first layer of material on the substrate, wherein the first layer of material comprises silicon oxide;

providing a germanium-containing precursor and an oxygen-containing precursor to the processing region of the semiconductor processing chamber;

forming a plasma of the germanium-containing precursor and the oxygen-containing precursor in the processing region; and

forming a second layer of material on the substrate, wherein the second layer of material comprises germanium oxide, and wherein a ratio of germanium to oxygen in the second layer of material is less than or equal to 1:2.

17. The semiconductor processing method of claim 16, wherein the oxygen-containing precursor provided with the silicon-containing precursor is a similar precursor as the oxygen-containing precursor provided with the germanium-containing precursor.

18. The semiconductor processing method of claim 17, wherein a flow rate of the oxygen-containing precursor is increased from a first flow rate provided while providing the silicon-containing precursor to a second flow rate while providing the germanium-containing precursor.

19. The semiconductor processing method of claim 16, wherein forming the plasma of the germanium-containing precursor is performed at a plasma power of greater than or equal to 800 W.

20. The semiconductor processing method of claim 16, wherein:

a temperature within the semiconductor processing chamber is maintained at less than or equal to 550 °C while forming the first layer of material and the second layer of material on the substrate; and

a pressure within the semiconductor processing chamber is maintained at less than or equal to 6 Torr while forming the first layer of material and the second layer of material on the substrate.