What is claimed is:

1. A method of controlling a substrate temperature during a plasma ion implantation process comprising:

(a) performing a first portion of a plasma ion implantation process on a substrate having a magnetically susceptible layer formed thereon in a processing chamber for a first time period, wherein a temperature of the substrate is maintained below about 150 degrees Celsius;

(b) cooling the temperature of the substrate after the first portion of the plasma ion implantation process has been completed; and

(c) performing a second portion of the plasma ion implantation process on the substrate, wherein the temperature of the substrate is maintained below 150 degrees Celsius.

2. The method of claim 1, further comprising:

repeating step (b) - (c) in-situ a processing chamber.

3. The method of claim 1, further comprising:

repeating (b) – (c) until a dopant concentration of the substrate has reached between about $1xE10^{18}$ atoms/cm^3 and about $1xE10^{23}$ atoms/cm^3.

4. The method of claim 1, wherein cooling further comprises:

turning off bias power used during the first portion of the plasma ion implantation process.

5. The method of claim 1, wherein cooling is performed outside of the processing chamber in which the first portion of the plasma ion implantation process was performed.

6. The method of claim 5, wherein the second portion of the plasma ion implantation process is performed in a second processing chamber.

7. The method of claim 1, wherein the first portion of the plasma ion implantation process has a duration of between about 5 seconds and about 40 seconds.

8. The method of claim 1, wherein performing the plasma ion implantation process on the substrate further comprises:

implanting ions into a portion of the magnetically susceptible layer exposed by a patterned mask layer disposed on the substrate.

9. The method of claim 8, wherein the ions implanted into the magnetically susceptible layer are selected from a group consisting of boron, phorosphine, and arsine.

10. The method of claim 1, wherein the magnetically susceptible layer includes a first layer disposed on a second layer.

11. The method of claim 10, wherein the first layer is selected from a group consisting of iron, nickel, platinum, and combinations thereof; and the second layer is selected from a group consisting of cobalt, chromium, platinum, tantalum, iron, terbium, gadolinium, and combinations thereof.

12. The method of claim 1, wherein performing the first portion of the plasma ion implantation process further comprises:

applying a RF energy to a gas mixture supplied into the processing chamber to ionize at least a portion of the gas mixture.

13. The method of claim 12, wherein the RF energy is supplied in a pulsed mode.

14. The method of claim 1, wherein the cooling process further comprises:

supplying a cooling gas to the surface of the substrate.

15. The method of claim 14, wherein the cooling gas includes at least one of He, Ar, H_2, N_2 or N_2O.

What is claimed is:

1. A method of controlling a substrate temperature during a plasma ion implantation process comprising:

(a) supplying an implantation energy to perform a first portion of a plasma ion implantation process on a substrate having a magnetically susceptible layer formed thereon in a processing chamber for a first time period, wherein a temperature of the substrate is maintained below about 150 degrees Celsius;

(b) cooling the temperature of the substrate after the first portion of the plasma ion implantation process has been completed by turning off bias power while maintaining the implantation energy on; and

(c) performing a second portion of the plasma ion implantation process on the substrate, wherein the temperature of the substrate is maintained below 150 degrees Celsius.

2. The method of claim **1**, further comprising:

repeating step (b)-(c) in-situ a processing chamber.

3. The method of claim **1**, further comprising:

repeating (b)-(c) until a dopant concentration of the substrate has reached between about 1×10^{18} atoms/cm^3 and about 1×10^{23} atoms/cm^3.

4. The method of claim **1**, wherein the first portion of the plasma ion implantation process has a duration of between about 5 seconds and about 40 seconds.

5. The method of claim **1**, wherein performing the plasma ion implantation process on the substrate further comprises:

implanting ions into a portion of the magnetically susceptible layer exposed by a patterned mask layer disposed on the substrate.

6. The method of claim **5**, wherein the ions implanted into the magnetically susceptible layer are selected from a group consisting of boron, phorosphine, and arsine.

7. The method of claim 1, wherein the magnetically susceptible layer includes a first layer disposed on a second layer.

8. The method of claim 7, wherein the first layer is selected from a group consisting of iron, nickel, platinum, and combinations thereof; and the second layer is selected from a group consisting of cobalt, chromium, platinum, tantalum, iron, terbium, gadolinium, and combinations thereof.

9. The method of claim 1, wherein the implantation energy is supplied to a gas mixture in the processing chamber to ionize at least a portion of the gas mixture.

10. The method of claim 9, wherein the RF energy is supplied in a pulsed mode.

11. The method of claim 1, wherein the cooling process further comprises:

supplying a cooling gas to the surface of the substrate.

12. The method of claim 11, wherein the cooling gas includes at least one of He, Ar, H_2, N_2 or N_2O.

13. A method of controlling a substrate temperature during a plasma ion implantation process comprising:

(a) supplying an implantation energy to perform a first portion of a plasma ion implantation process on a substrate having a magnetically susceptible layer formed thereon in a processing chamber for a first time period, wherein a temperature of the substrate is maintained below about 150 degrees Celsius;

(b) turning off bias power while maintaining the implantation energy on during the first portion of the plasma ion implantation process to cool down the temperature between about 15 degrees Celsius and about 30 degrees Celsius; and

(c) continuing performing a second portion of the plasma ion implantation process on the substrate, wherein the temperature of the substrate is maintained below 150 degrees Celsius.

14. The method of claim 13, further comprising:

repeating step (b)-(c) in-situ a processing chamber.

15. The method of claim 13, further comprising:

repeating (b)-(c) until a dopant concentration of the substrate has reached between about 1×10^{18} atoms/cm^3 and about 1×10^{23} atoms/cm^3.

16. The method of claim 13, wherein turning off the bias power further comprises:

supplying a cooling gas to the substrate surface.

17. The method of claim 16, wherein the cooling gas includes at least one of He, Ar, H_2, N_2 or N_2O.