PATENT
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Replacement Sheets

1. A method of forming a film on a substrate, comprising:

positioning a substrate within a processing chamber;

heating the substrate to a temperature within a range from about 550 degrees Celsius to about 750 degrees Celsius;

introducing one or more process gases into the processing chamber, the one or more process gases comprising a silicon source and a phosphorus source; and

depositing a substantially carbon-free epitaxial layer comprising Si_3P_4 on the substrate, the substantially carbon-free epitaxial layer having a phosphorus concentration of $1x10^{21}$ atoms per cubic centimeter or greater, wherein the substantially carbon-free epitaxial layer is deposited at a chamber pressure of about 150 Torr or greater.

2. The method of claim 1, wherein the chamber pressure is about 300 Torr or greater.

3. The method of claim 1, wherein the silicon precursor is dichlorosilane.

4. The method of claim 3, wherein the phosphorus precursor is phosphine.

5. The method of claim 1, wherein the temperature is within a range from about 600 degrees Celsius to about 650 degrees Celsius.

6. The method of claim 5, wherein the silicon precursor is silane or disilane.

7. The method of claim 1, wherein the substantially carbon-free epitaxial layer has a tensile strain of about 1 gigapascal to about 1.5 gigapascals.

8. A method of forming a film on a substrate, comprising:

positioning a substrate within a processing chamber;

heating the substrate to a temperature within a range from about 600 degrees Celsius to about 650 degrees Celsius;

introducing one or more process gases into the processing chamber, the one or more process gases comprising a silicon source and a phosphorus source; and

depositing a substantially carbon-free epitaxial layer comprising Si_3P_4 on the substrate, the substantially carbon-free epitaxial layer having a phosphorus concentration of $1x10^{21}$ atoms per cubic centimeter or greater, wherein the substantially carbon-free epitaxial layer is deposited at a chamber pressure of about 300 Torr or greater.

9. The method of claim 8, wherein the substantially carbon-free epitaxial layer has a tensile strain of about 1 gigapascal to about 1.5 gigapascals.

10. The method of claim 9, wherein the silicon precursor is silane or disilane.

11. The method of claim 8, wherein the phosphorus precursor is phosphine.

12. The method of claim 1, wherein the silicon precursor is dichlorosilane.

13. A method of forming a film on a substrate, comprising:

positioning a substrate within a processing chamber;

heating the substrate to a temperature within a range from about 550 degrees Celsius to about 750 degrees Celsius;

introducing phosphine and at least one silane or disilane into the processing chamber; and

depositing a substantially carbon-free epitaxial layer comprising Si_3P_4 on the substrate, the substantially carbon-free epitaxial layer having a phosphorus concentration of $1x10^{21}$ atoms per cubic centimeter or greater, wherein the substantially carbon-free epitaxial layer is deposited at a chamber pressure of about 150 Torr or greater.

14. The method of claim 13, wherein the chamber pressure is about 300 Torr or greater.

15. The method of claim 4 wherein the temperature is within a range from about 600 degrees Celsius to about 650 degrees Celsius, and wherein the silicon epitaxial layer has a tensile strain of about 1 gigapascal to about 1.5 gigapascals.

CLAIMS

1. A method of forming a film on a substrate, comprising:

positioning a substrate within a processing chamber;

heating the substrate to a temperature within a range from about 550 degrees Celsius to about 750 degrees Celsius;

introducing one or more process gases into the processing chamber, the one or more process gases comprising a silicon source and a phosphorus source; and

depositing a substantially carbon-free epitaxial layer comprising Si_3P_4 on the substrate, the substantially carbon-free epitaxial layer having a phosphorus concentration of $1x10^{21}$ atoms per cubic centimeter or greater, wherein the substantially carbon-free epitaxial layer is deposited at a chamber pressure of about 150 Torr or greater.

2. The method of claim 1, wherein the chamber pressure is about 300 Torr or greater.

3. The method of claim 1, wherein the silicon precursor is dichlorosilane.

4. The method of claim 3, wherein the phosphorus precursor is phosphine.

5. The method of claim 1, wherein the temperature is within a range from about 600 degrees Celsius to about 650 degrees Celsius.

6. The method of claim 5, wherein the silicon precursor is silane or disilane.

7. The method of claim 1, wherein the substantially carbon-free epitaxial layer has a tensile strain of about 1 gigapascal to about 1.5 gigapascals.

8. A method of forming a film on a substrate, comprising:

positioning a substrate within a processing chamber;

heating the substrate to a temperature within a range from about 600 degrees Celsius to about 650 degrees Celsius;

introducing one or more process gases into the processing chamber, the one or more process gases comprising a silicon source and a phosphorus source; and

depositing a substantially carbon-free epitaxial layer comprising Si_3P_4 on the substrate, the substantially carbon-free epitaxial layer having a phosphorus concentration of $1x10^{21}$ atoms per cubic centimeter or greater, wherein the substantially carbon-free epitaxial layer is deposited at a chamber pressure of about 300 Torr or greater.

9. The method of claim 8, wherein the substantially carbon-free epitaxial layer has a tensile strain of about 1 gigapascal to about 1.5 gigapascals.

10. The method of claim 9, wherein the silicon precursor is silane or disilane.

11. The method of claim 8, wherein the phosphorus precursor is phosphine.

12. The method of claim 11, wherein the silicon precursor is dichlorosilane.

13. A method of forming a film on a substrate, comprising:

positioning a substrate within a processing chamber;

heating the substrate to a temperature within a range from about 550 degrees Celsius to about 750 degrees Celsius;

introducing phosphine and at least one of silane or disilane into the processing chamber; and

depositing a substantially carbon-free epitaxial layer comprising Si_3P_4 on the substrate, the substantially carbon-free epitaxial layer having a phosphorus concentration of $1x10^{21}$ atoms per cubic centimeter or greater, wherein the substantially carbon-free epitaxial layer is deposited at a chamber pressure of about 150 Torr or greater.

14. The method of claim 13, wherein the chamber pressure is about 300 Torr or greater.

15. The method of claim 14, wherein the temperature is within a range from about 600 degrees Celsius to about 650 degrees Celsius.

16. The method of claim 15, wherein the substantially carbon-free epitaxial layer has a tensile strain of about 1 gigapascal to about 1.5 gigapascals.