What is claimed is:

1. A method for making a perpendicular magnetic recording disk comprising:

providing a substrate;

forming on the substrate a plurality of grains of a substantially chemically-ordered alloy comprising Pt and an element selected from Fe and Co, the grains being covered by a plurality of layers of graphitic carbon; and

etching the carbon layers to expose said grains.

2. The method of claim 1 further comprising, after exposing said grains, depositing Pt, said selected element and carbon simultaneously onto the exposed said grains to increase the thickness of said grains, the simultaneously deposited carbon forming a plurality of layers of graphitic carbon over the increased-thickness grains.

3. The method of claim 2 wherein, after exposing said grains, depositing Pt, said selected element and carbon simultaneously comprises depositing Pt, said selected element and carbon simultaneously onto a substrate maintained at a temperature between about 500 to 700 °C.

4. The method of claim 2 wherein, after exposing said grains, depositing Pt, said selected element and carbon simultaneously comprises depositing Pt, said selected element and carbon simultaneously onto a substrate maintained at a temperature between about 350 to 500 °C and thereafter annealing the deposited Pt, said selected element and carbon to a temperature between about 500 to 700 °C for between about 10 to 120 minutes.

5. The method of claim 1 wherein etching comprises etching with a chemically reactive plasma of Ar and hydrogen (H_2).

6. The method of claim 1 wherein forming said grains covered by said carbon layers comprises depositing Pt, said selected element and carbon simultaneously onto a substrate maintained at a temperature between about 500 to 700 °C.

7. The method of claim 1 wherein forming said grains covered by said carbon layers comprises depositing Pt, said selected element and carbon simultaneously onto a substrate maintained at a temperature between about 350 to 500 °C and thereafter annealing the deposited Pt, said selected element and carbon to a temperature between about 500 to 700 °C for between about 10 to 120 minutes.

8. The method of claim 1 wherein forming on the substrate a plurality of grains of a substantially chemically-ordered alloy comprises forming a substantially chemically-ordered pseudo-binary FePtX alloy in the $L1_0$ phase, where X is one or more of Ni, Au, Cu, Pd, Mn and Ag.

9. The method of claim 1 wherein forming on the substrate a plurality of grains of a substantially chemically-ordered alloy comprises forming a substantially chemically-ordered pseudo-binary CoPtX alloy in the $L1_0$ phase, where X is one or more of Ni, Au, Cu, Pd, Mn and Ag.

10. The method of claim 1 wherein said grains are also separated from one another on the substrate by a plurality of layers of graphitic carbon, and wherein etching the carbon layers comprises etching both the carbon layers covering the grains and the carbon layers separating the grains.

11. The method of claim 1 further comprising, after exposing said grains, depositing Pt, said selected element, carbon and a segregant selected from one or more of SiO_2, TiO_2, TaO_x, SiC, SiN, TiC, and TiN.

12. The method of claim 1 further comprising, after exposing said grains, depositing a layer of ferromagnetic material directly on and in contact with said exposed grains, said ferromagnetic layer being exchange coupled with said grains of Pt and said selected element.

13. A method for making a perpendicular magnetic recording disk comprising:

providing a substrate;

forming on the substrate a plurality of grains of a substantially chemically-ordered alloy comprising Fe and Pt and a plurality of layers of graphitic carbon, the carbon layers generally encapsulating the FePt grains;

etching the carbon layers in Ar and hydrogen (H_2) to expose the tops of said FePt grains; and

depositing Fe, Pt and carbon simultaneously onto the exposed FePt grains to increase the thickness of said grains, the simultaneously deposited carbon forming a plurality of layers of graphitic carbon over the increased-thickness grains.

14. The method of claim 13 wherein forming said grains encapsulated by said carbon layers comprises depositing Fe, Pt and carbon simultaneously while maintaining the substrate at a temperature between 500 to 700 °C.

15. The method of claim 13 wherein forming said grains encapsulated by said carbon layers comprises depositing Fe, Pt and carbon simultaneously while maintaining the substrate at a temperature between 350 to 500 °C and thereafter annealing the deposited Fe, Pt, and carbon to a temperature between about 500 to 700 °C for between about 10 to 120 minutes.

16. The method of claim 13 wherein depositing Fe, Pt and carbon simultaneously onto the exposed FePt grains to increase the thickness of said grains comprises depositing Fe, Pt and carbon simultaneously while maintaining the substrate at a temperature between 500 to 700 °C.

17. The method of claim 13 wherein depositing Fe, Pt and carbon simultaneously onto the exposed FePt grains to increase the thickness of said grains comprises depositing Fe, Pt and carbon simultaneously while maintaining the substrate at a temperature between 350 to 500 °C and thereafter annealing the deposited Fe, Pt, and carbon to a temperature between about 500 to 700 °C for between about 10 to 120 minutes.

18. The method of claim 13 wherein forming a plurality of grains of a substantially chemically-ordered alloy comprising Fe and Pt comprises forming a substantially chemically-ordered pseudo-binary FePtX alloy in the $L1_0$ phase, where X is one or more of Ni, Au, Cu, Pd, Mn and Ag.

19. The method of claim 13 wherein etching the carbon layers further comprises etching the carbon between the grains to remove substantially all of the carbon.

20. The method of claim 19 wherein depositing Fe, Pt and carbon simultaneously onto the exposed FePt grains comprises depositing one or more segregant materials selected from SiO_2, TiO_2, TaO_x, SiC, SiN, TiC, and TiN.

What is claimed is:

1. A method for making a perpendicular magnetic recording disk comprising:

providing a substrate;

forming on the substrate a plurality of grains of a substantially chemically-ordered alloy comprising Pt and an element selected from Fe and Co, the grains being covered by a plurality of layers of graphitic carbon;

etching the carbon layers to expose said grains; and

depositing Pt, said selected element and carbon simultaneously the said grains to increase the thickness of said grains, the simultaneously deposited carbon forming plurality of layers of graphitic carbon over the increased-thickness grains.

2. The method of claim 1 wherein, after exposing said grains, depositing Pt, said selected element and carbon simultaneously comprises depositing Pt, said selected element and carbon simultaneously onto a substrate maintained at a temperature between about 500 to 700° C.

3. The method of claim 1 wherein, after exposing said grains, depositing Pt, said selected element and carbon simultaneously comprises depositing Pt, said selected element and carbon simultaneously onto a substrate maintained at a temperature between about 350 to 500° C. and thereafter annealing the deposited Pt, said selected element and carbon to a temperature between about 500 to 700° C. for between about 10 to 120 minutes.

4. The method of claim 1 wherein etching comprises etching with a chemically reactive plasma of Ar and hydrogen (H_2).

5. The method of claim 1 wherein forming said grains covered by said carbon layers comprises depositing Pt, said selected element and carbon simultaneously onto a substrate maintained at a temperature between about 500 to 700° C.

6. The method of claim 1 wherein forming said grains covered by said carbon layers comprises depositing Pt, said selected element and carbon simultaneously onto a substrate maintained at a temperature between about 350 to 500° C. and thereafter annealing the deposited Pt, said selected element and carbon to a temperature between about 500 to 700° C. for between about 10 to 120 minutes.

7. The method of claim 1 wherein forming on the substrate a plurality of grains of a substantially chemically-ordered alloy comprises forming a substantially chemically-ordered pseudo-binary FePtX alloy in the $L1_0$ phase, where X is one or more of Ni, Au, Cu, Pd, Mn and Ag.

8. The method of claim 1 wherein forming on the substrate a plurality of grains of a substantially chemically-ordered alloy comprises forming a substantially chemically-ordered pseudo-binary CoPtX alloy in the $L1_0$ phase, where X is one or more of Ni, Au, Cu, Pd, Mn and Ag.

9. The method of claim 1 wherein said grains are also separated from one another on the substrate by a plurality of layers of graphitic carbon, and wherein etching the carbon layers comprises etching both the carbon layers covering the grains and the carbon layers separating the grains.

10. The method of claim 1 further comprising, after exposing said grains, depositing Pt, said selected element, carbon and a segregant selected from one or more of SiO_2, TiO_2, TaO_x, SiC, SiN, TiC, and TiN.

11. A method for making a perpendicular magnetic recording disk comprising:

providing a substrate;

forming on the substrate a plurality of grains of a substantially chemically-ordered alloy comprising Fe and Pt and a plurality of layers of graphitic carbon, the carbon layers generally encapsulating the FePt grains;

etching the carbon layers in Ar and hydrogen (H_2) to expose the tops of said FePt grains; and

depositing Fe, Pt and carbon simultaneously onto the exposed FePt grains to increase the thickness of said grains, the simultaneously deposited carbon forming a plurality of layers of graphitic carbon over the increased-thickness grains.

12. The method of claim 11 wherein forming said grains encapsulated by said carbon layers comprises depositing Fe, Pt and carbon simultaneously while maintaining the substrate at a temperature between 500 to 700° C.

13. The method of claim 11 wherein forming said grains encapsulated by said carbon layers comprises depositing Fe, Pt and carbon simultaneously while maintaining the substrate at a temperature between 350 to 500° C. and thereafter annealing the deposited Fe, Pt, and carbon to a temperature between about 500 to 700° C. for between about 10 to 120 minutes.

14. The method of claim 11 wherein depositing Fe, Pt and carbon simultaneously onto the exposed FePt grains to increase the thickness of said grains comprises depositing Fe, Pt and carbon simultaneously while maintaining the substrate at a temperature between 500 to 700° C.

15. The method of claim 11 wherein depositing Fe, Pt and carbon simultaneously onto the exposed FePt grains to increase the thickness of said grains comprises depositing Fe, Pt and carbon simultaneously while maintaining the substrate at a temperature between 350 to 500° C. and thereafter annealing the deposited Fe, Pt, and carbon to a temperature between about 500 to 700° C. for between about 10 to 120 minutes.

16. The method of claim 11 wherein forming a plurality of grains of a substantially chemically-ordered alloy comprising Fe and Pt comprises forming a substantially chemically-ordered pseudo-binary FePtX alloy in the $L1_0$ phase, where X is one or more of Ni, Au, Cu, Pd, Mn and Ag.

17. The method of claim 11 wherein etching the carbon layers further comprises etching the carbon between the grains to remove substantially all of the carbon.

18. The method of claim 17 wherein depositing Fe, Pt and carbon simultaneously onto the exposed FePt grains comprises depositing one or more segregant materials selected from SiO_2, TiO_2, TaO_x, SiC, SiN, TiC, and TiN.

19. A method for making a perpendicular magnetic recording disk comprising:

providing a substrate;

forming on the substrate a plurality of grains of a substantially chemically-ordered alloy comprising Pt and an element selected from Fe and Co, the grains being cov-

ered by a plurality of layers of graphitic carbon;

etching the carbon layers to expose said grains; and

after exposing said grains, depositing Pt, said selected element, carbon and a segregant selected from one or more of SiO_2, TiO_2, TaO_x, SiC, SiN, TiC, and TiN onto said exposed grains.

20. A method for making a perpendicular magnetic recording disk comprising:

providing a substrate;

forming on the substrate a first layer of a plurality of grains of a substantially chemically-ordered alloy comprising Fe and Pt and a plurality of layers of graphitic carbon, the carbon layers generally encapsulating the FePt grains;

etching the carbon layers to expose the tops of said FePt grains in said first layer;

forming a second layer of FePt on said FePt grains in said first layer by depositing Fe and Pt simultaneously onto the exposed FePt grains in said first layer to thereby form increased-thickness FePt grains; and

depositing a layer of ferromagnetic material directly on and in contact with said increased-thickness FePt grains, said ferromagnetic layer being exchange coupled with said increased-thickness FePt grains.