What is claimed is:

1. A vapor deposition process for depositing a germanium antimony tellurium material on a substrate, comprising volatilizing a germanium precursor comprising germanium bis(n-butyl, N,N-diisopropylamidinate) to form a germanium-containing precursor vapor, volatilizing an organo-antimony precursor to form an antimony-containing precursor vapor, and volatilizing an organo-tellurium precursor to form a tellurium-containing precursor vapor, and contacting the germanium-containing precursor vapor, antimony-containing precursor vapor, and tellurium-containing precursor vapor with the substrate at conditions effective for deposition, to deposit said germanium antimony tellurium material on the substrate.

2. The process of claim 1, wherein the organo-tellurium precursor comprises a dialkyl or diamido tellurium precursor.

3. The process of claim 1, wherein the organo-tellurium precursor comprises di-t-butyl tellurium.

4. The process of claim 1, wherein the organo-antimony precursor comprises a trialkyl antimony compound or a triamido antimony compound.

5. The process of claim 1, wherein the organo-antimony precursor comprises a tris-dialkylamido antimony compound.

6. The process of claim 1, wherein the organo-antimony precursor comprises tris(dimethylamino)antimony.

7. The process of any one of claims 1 to 6, wherein said contacting conditions comprise temperature of 300°C to 450°C.

8. The process of any one of claims 1 to 6, wherein pressure in said contacting conditions comprise pressure of 0.5 Torr to 15 atmospheres.

9. The process of any of claims 1 to 6, comprising use of a carrier gas in the contacting step.

10. The process of any of claims 1 to 6, comprising use of a reducing co-reactant in the contacting step.

11. The process of claim 10, wherein the reducing co-reactant is selected from the group consisting of hydrogen, hydrogen plasma, alkanes, alkenes, amidines, guanidines, boranes and their adducts and derivatives, alkynes, alkylamines, silanes, silyl chalcogenides, germanes, ammonia, amines, imines, and hydrazines.

12. The process of claim 10, wherein the reducing co-reactant is selected from the group consisting of hydrogen, hydrogen plasma, and ammonia.

13. The process of any one of claims 1 to 6, comprising chemical vapor deposition of the germanium antimony tellurium material on the substrate.

14. The process of any one of claims 1 to 6, comprising atomic layer deposition of the smooth amorphous germanium antimony tellurium material on the substrate.

15. The process of any one of claims 1 to 6, wherein the substrate comprises a microelectronic device substrate.

16. The process of claim 15, comprising forming a phase change memory cell on the microelectronic device substrate.

17. The process of claim 16, wherein the germanium antimony tellurium material is deposited in a via on the microelectronic device substrate.

18. The process of claim 17, wherein the via is in a low k dielectric material.

19. The process of claim 17, wherein the via is in a silicon oxide material.

20. The process of claim 17, wherein the via is in a silicon nitride material.

21. The process of any one of claims 1 to 6, wherein said contacting conditions comprise temperature below 300°C.

22. The process of any one of claims 1 to 6, wherein said germanium antimony tellurium material contains carbon.

23. The process of any one of claims 1 to 6, wherein germanium is deposited in a via or trench on said substrate.

24. A germanium antimony tellurium film formed by the process of any one of claims 1 to 6.

25. A phase change memory device comprising the germanium antimony tellurium film of claim 24.

26. A method of manufacturing a phase change memory device comprising the process of claim 1.

27. A germanium antimony tellurium alloy formed by a process including vapor deposition of germanium from a germanium precursor comprising germanium bis(n-butyl, N,N-diisopropylamidinate).

28. A precursor solution comprising germanium bis(n-butyl, N,N-diisopropylamidinate) and a solvent therefor.

29. The precursor solution of claim 28, wherein the solvent is selected from the group consisting of alkane solvents, aryl solvents, amines, imines, guanidines, amidines, and hydrazines.

30. The precursor solution of claim 28, wherein the solvent is selected from the group consisting of hexane, heptane, octane, pentane, benzene, toluene, triethylamine, and tert-butylamine.

31. The precursor solution of claim 28, wherein the solvent is toluene.

32. An atomic layer deposition process for forming a germanium antimony tellurium film, wherein the film is formed by pulsed formation of the film wherein the germanium, antimony and tellurium precursors are pulsed in a manner to control composition of the film, and the germanium precursor comprises germanium bis(n-butyl, N,N-diisopropylamidinate).

33. The process of claim 32, comprising a pulse cycle including sequential introduction precursor species in the sequence Te-Ge-Te-Sb-Te-Ge-Te-Sb-Te, repetitively conducted until a desired film thickness has been achieved.

34. A process of forming a germanium-containing film, wherein the germanium is deposited in a deposition operation, using a germanium precursor comprising germanium bis(n-butyl, N,N-diisopropylamidinate), with co-reactant added in the deposition operation to incorporate oxygen and/or nitrogen in the film.

35. The process of claim 34, wherein the co-reactive comprises a co-reactive species selected from the group consisting of N_2O, O_2, and NO.

36. The process of any one of claims 1 to 6, wherein the germanium precursor is delivered in solution or suspension in a liquid delivery technique.

37. The process of claim 36, wherein the germanium precursor is in solution or suspension in a solvent selected from the group consisting of alkane solvents, aryl solvents, amines, imines, guanidines, amidines, and hydrazines.

38. The process of claim 36, wherein the germanium precursor is in solution or suspension in a solvent selected from the group consisting of hexane, heptane, octane, pentane, benzene, toluene, triethylamine, and tert-butylamine.

39. The process of claim 36, wherein the germanium precursor is in solution or suspension in toluene.

40. A process for lowering reset current of a germanium antimony tellurium material, wherein the germanium is deposited in a deposition operation, using a germanium precursor comprising germanium bis(n-butyl, N,N-diisopropylamidinate), comprising doping the germanium antimony tellurium material with silicon and nitrogen.

41. The germanium antimony tellurium film of claim 24, doped with silicon and nitrogen.

42. The germanium antimony tellurium film of claim 24, having oxygen and/or nitrogen incorporated therein.

43. A vapor deposition process for depositing a germanium antimony tellurium material on a substrate, comprising volatilizing a germanium amidinate precursor to form a germanium-containing precursor vapor, volatilizing an organo-antimony precursor to form an antimony-containing precursor vapor, and volatilizing an organo-tellurium precursor to form a tellurium-containing precursor vapor, and contacting the germanium-containing precursor vapor, antimony-containing precursor vapor, and tellurium-containing precursor vapor with the substrate at conditions effective for deposition, to deposit said germanium antimony tellurium material on the substrate.

44. The process of any one of claims 1 to 6 and 43, wherein the organo-antimony precursor is selected from the group consisting of organic-antimony precursors of the formulae:

$$Sb(NR^1R^2)(R^3N(CR^5R^6)_mNR^4) \quad (A)$$

wherein:

R^1, R^2, R^3, and R^4 may be the same as or different from one another, and are independently selected from C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl (e.g., vinyl, allyl, etc.), C_3-C_6 alkylsilyl, C_6-C_{10} aryl,

each of R^5 and R^6 may be the same as or different from one another and are independently selected from hydrogen, C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl (e.g., vinyl, allyl, etc.), C_3-C_6 alkylsilyl, and C_6-C_{10} aryl; and

m is an integer from 1 to 4 inclusive;

$$\mathbf{Sb(R^1)(R^2N(CR^4R^5)_mNR^3)} \quad \text{(B)}$$

wherein:
R^1, R^2, and R^3 may be the same as or different from one another, and are independently selected from C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl (e.g., vinyl, allyl, etc.), C_3-C_6 alkylsilyl, and C_6-C_{10} aryl;

each of R^4 and R^5 may be the same as or different from one another and is independently selected from hydrogen, C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl (e.g., vinyl, allyl, etc.), C_3-C_6 alkylsilyl, and C_6-C_{10} aryl; and

m is an integer from 1 to 4 inclusive;

$$\mathbf{Sb(R^1)_{3-n}(NR^2R^3)_n} \quad \text{(C)}$$

wherein:

R^1, R^2 and R^3 may be the same as or different from one another and are independently selected from hydrogen, C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl (e.g., vinyl, allyl, etc.), silyl, C_3-C_6 alkylsilyl, C_6-C_{10} aryl and $-NR^4R^5$, wherein each of R^4 and R^5 is selected from among H and C_1-C_4 alkyl; and

n is an integer from 0 to 3 inclusive; and

$$\mathbf{(R^4)_nSb(Si(R^1R^2R^3))_{3-n}} \quad \text{(D)}$$

wherein:

R^1, R^2, R^3, and R^4 may be the same as or different from one another, and are independently selected from C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_3-C_6 alkylsilyl, C_6-C_{10} aryl, and alkylamino of the formula $-NR^5R^6$ wherein each of R^5 and R^6 is independently selected from H and C_1-C_4 alkyl; and

n is an integer from 0 to 3 inclusive.

45. The process of any one of claims 1 to 6 and 43, wherein the organic-antimony precursor comprises a precursor selected from the group consisting of $Sb(NMeEt)_3$, $Sb(NMe_2)_3$, $Sb(CH{=}CMe_2)_3$ and $Sb(CH_2CH{=}CH_2)_3$.

46. The process of any one of claims 1 to 6 and 43, wherein the organic-antimony precursor comprises a precursor selected from the group consisting of precursors (F), (G), (H), (I), (J), (L) and (M):

(F) amidinates, guanidinates and isoureates of the formula:

$R^7{}_nSb[R^1NC(X)NR^2]_{3-n}$

wherein:
where each R^1 and R^2 is independently selected from among H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and -$Si(R^3)_3$ wherein each R^3 is independently selected from C_1-C_6 alkyl;

each X is independently selected from among C_1-C_6 alkoxy, -NR^4R^5, and -$C(R^6)_3$, wherein each of R^4, R^5 and R^6 is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and -$Si(R^3)_3$ wherein each R^3 is independently selected from C_1-C_6 alkyl;

each R^7 is independently selected from among C_1-C_6 alkoxy, –NR^8R^9, and -$C(R^{10})_3$, wherein each of R^8, R^9 and R^{10} is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, -$Si(R^3)_3$, and -$Ge(R^3)_3$ wherein each R^3 is independently selected from C_1-C_6 alkyl; and

n is an integer from 0 to 3;

(G) tetra-alkyl guanidates of the formula:

$R^5{}_nSb[(R^1R^2)NC(NR^3R^4)N)]_{3-n}$

wherein:
each of R^1 and R^2 is independently selected from among H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and -$Si(R^9)_3$ wherein each R^9 is independently selected from C_1-C_6 alkyl;

each of R^3 and R^4 is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and -$Si(R^9)_3$ wherein each R^9 is independently selected from C_1-C_6 alkyl;

each R^5 is independently selected from among C_1-C_6 alkoxy, –NR^6R^7, and -$C(R^8)_3$, wherein each of R^6, R^7 and R^8 is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, -$Si(R^9)_3$, and -$Ge(R^9)_3$ wherein each R^9 is independently selected from C_1-C_6 alkyl; and

n is an integer from 0 to 3.

(H) carbamates and thiocarbamates of the formula:

$R^4{}_nSb[(EC(X)E]_{3-n}$

wherein:
each X is independently selected from among C_1-C_6 alkoxy, $-NR^1R^2$, and $-C(R^3)_3$, wherein each of R^1, R^2 and R^3 is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and $-Si(R^5)_3$ wherein each R^5 is independently selected from C_1-C_6 alkyl;

each R^4 is independently selected from among C_1-C_6 alkoxy, $-NR^1R^2$, and $-C(R^3)_3$, wherein each of R^1, R^2 and R^3 is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and $-Si(R^5)_3$, $-Ge(R^5)_3$ wherein each R^5 is independently selected from C_1-C_6 alkyl;

E is either O or S; and

n is an integer from 0 to 3;

(I) beta-diketonates, diketoiminates, and diketiminates, of the formulae:

$[OC(R^3)C(X)C(R^2)O]_{3-n}Sb(R^5)_n$
$[OC(R^3)C(X)C(R^2)N(R^1)]_{3-n}Sb(R^5)_n$
$[R^4NC(R^3)C(X)C(R^2)N(R^1)]_{3-n}Sb(R^5)_n$
$[(R^3)OC(=O)C(X)C(R^2)S]_{3-n}Sb(R^5)_n$

where each of R^1,R^2, R^3 and R^4 is independently selected from among H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and $-Si(R^6)_3$ wherein each R^6 is independently selected from C_1-C_6 alkyl;

each X is independently selected from among C_1-C_6 alkoxy, $-NR^6R^7$, and $-C(R^8)_3$, wherein each of R^6, R^7 and R^8 is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and $-Si(R^6)_3$ wherein each R^6 is independently selected from C_1-C_6 alkyl;

each R^5 is independently selected from among guanidinate, aminidate, isoureate, allyl, C_1-C_6 alkoxy, $-NR^9R^{10}$, and $-C(R^{11})_3$, wherein each of R^9, R^{10} and R^{11} is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, $-Si(R^6)_3$, and $-Ge(R^6)_3$ wherein each R^6 is independently selected from C_1-C_6 alkyl; and

n is an integer from 0 to 3.

(J) allyls of the formulae:

(i): $R^4{}_nSb[R^1NC(X)C(R^2R^3)]_{3-n}$
(ii): $R^4{}_nSb[(R^1O)NC(X)C(R^2R^3))]_{3-n}$
(iii): $R^4{}_nSb[(R^1R^5)NC(X)C(R^2R^3))]_{3-n}$
(iv): $R^4Sb[(ONC(X)C(R^2R^3))]$

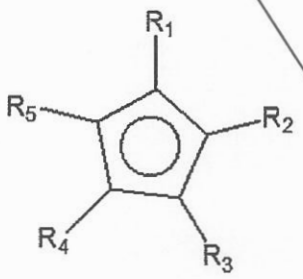
where each R^1,R^2, R^3 and R^5 is independently selected from among H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and $-Si(R^6)_3$ wherein each R^6 is independently selected from C_1-C_6 alkyl;

each X is independently selected from among C_1-C_6 alkoxy, $-NR^1R^2$, and $-C(R^3)_3$, wherein each of R^1, R^2 and R^3 is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and $-Si(R^6)_3$ wherein each R^6 is independently selected from C_1-C_6 alkyl;

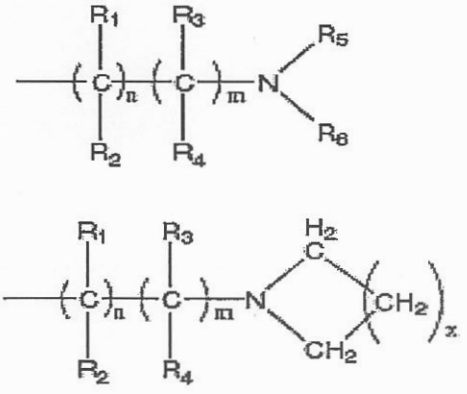
each R^4 is independently selected from among guanidinates, aminidates, isoureates, beta-diketonates, diketoiminates, diketiiminates, C_1-C_6 alkoxy, $-NR^7R^8$, and $-C(R^9)_3$, wherein each of R^7, R^8 and R^9 is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, $-Si(R^6)_3$, and $-Ge(R^6)_3$ wherein each R^6 is independently selected from C_1-C_6 alkyl; and

n is an integer from 0 to 3.

(L) cyclopentadienyl (Cp) antimony compounds wherein the Cp moiety is of the formulae:



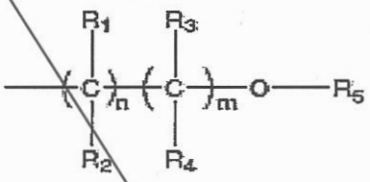
wherein each of R_1, R_2, R_3, R_4 and R_5 can be the same as or different from the others, and each is independently selected from among hydrogen, C_1-C_{12} alkyl, C_1-C_{12} alkylamino, C_6-C_{10} aryl, C_1-C_{12} alkoxy, C_3-C_6 alkylsilyl, C_2-C_{12} alkenyl, $R^1R^2NNR^3$, wherein R^1, R^2 and R^3 may be the same as or different from one another and each is independently selected from C_1-C_6 alkyl, and pendant ligands including functional group(s) providing further coordination to the antimony central atom, and selected from among aminoalkyl, alkoxyalkyl, aryloxyalkyl, imidoalkyl, and acetylalkyl, having the following formulae:



aminoalkyls

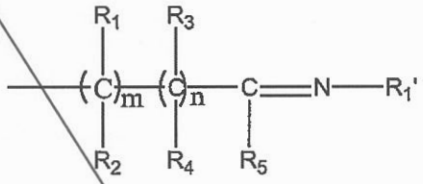
wherein: the methylene ($-CH_2-$) moiety could alternatively be another divalent hydrocarbyl moiety; each of R_1-R_4 is the same as or different from one another, with each being independently selected from among hydrogen, C_1-C_6 alkyl and C_6-C_{10} aryl; each of R_5 and R_6 is the same as or

different from the other, with each being independently selected from among C_1-C_6 alkyl; n and m are each selected independently as having a value of from 0 to 4, with the proviso that m and n cannot be 0 at the same time, and x is selected from 1 to 5;

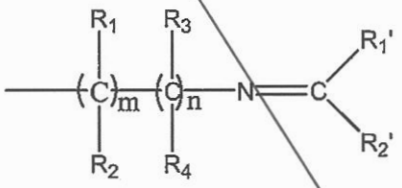


alkoxyalkyls and aryloxyalkyls

wherein each of R_1-R_4 is the same as or different from one another, with each being independently selected from among hydrogen, C_1-C_6 alkyl, and C_6-C_{10} aryl; R_5 is selected from among C_1-C_6 alkyl, and C_6-C_{10} aryl; and n and m are selected independently as having a value of from 0 to 4, with the proviso that m and n cannot be 0 at the same time;

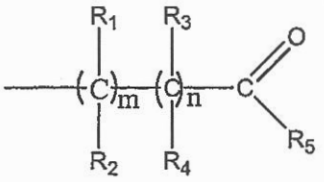


and



imidoalkyl

wherein each of R_1, R_2, R_3, R_4, R_5 is the same as or different from one another, with each being independently selected from among hydrogen, C_1-C_6 alkyl, and C_6-C_{10} aryl; each of R_1', R_2' is the same as or different from one another, with each being independently selected from C_1-C_6 alkyl, and C_6-C_{10} aryl; and n and m are selected independently from 0 to 4, with the proviso that m and n cannot be 0 at the same time;



acetylalkyls
wherein each of R_1-R_4 is the same as or different from one another, with each being independently selected from among hydrogen, C_1-C_6 alkyl, and C_6-C_{10} aryl; R_5 is selected from among C_1-C_6 alkyl, C_6-C_{10} aryl, and C_1-C_5 alkoxy; and n and m are selected independently from 0 to 4, with the proviso that m and n cannot be 0 at the same time;

wherein non-Cp ligand(s) of the antimony Cp compound can optionally include ligands selected from the group consisting of guanidinates, aminidates, isoureates, allyls, beta-diketonates, diketoiminates, and diketiiminates; and

(M) alkyls, alkoxides and silyls with pendent ligands, of the formulae:

(i): $R^5_nSb[(R^1R^2)N(CH_2)_mC(R^1R^2)]_{3-n}$
(ii): $R^5_nSb[(R^1R^2)N(CH_2)_mSi(R^1R^2)]_{3-n}$
(iii): $R^5_nSb[(R^1R^2)N(CH_2)_mO]_{3-n}$

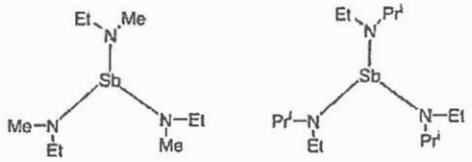
where each of R^1 and R^2 is independently selected from among H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, and -$Si(R^3)_3$ wherein each R^3 is independently selected from C_1-C_6 alkyl;

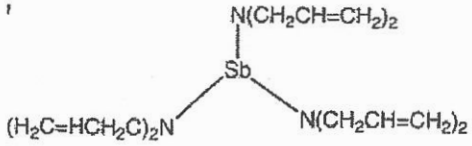
each R^5 is independently selected from among guanidinates, aminidates, isoureates, beta-diketonates, diketoiminates, diketiiminates, C_1-C_6 alkoxy, $-NR^6R^7$, and -$C(R^8)_3$, wherein each of R^6, R^7 and R^8 is independently selected from H, C_1-C_6 alkyl, C_5-C_{10} cycloalkyl, C_6-C_{10} aryl, -$Si(R^3)_3$, and -$Ge(R^3)_3$ wherein each R^3 is independently selected from C_1-C_6 alkyl;

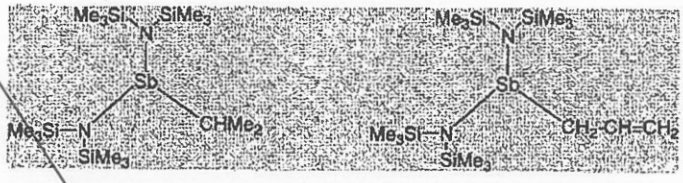
n is an integer from 0 to 3;

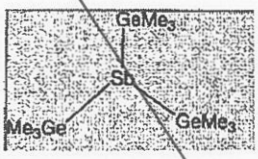
m is integer from 0 to 4.

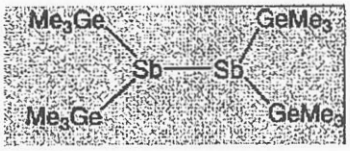
47. The process of any one of claims 1 to 6 and 43, wherein the organic-antimony precursor comprises a precursor selected from the group consisting of:

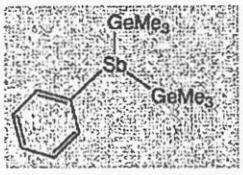


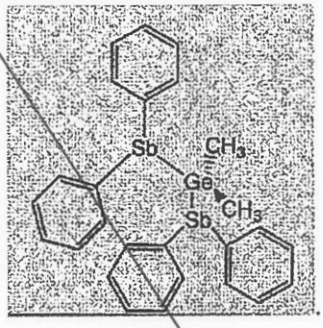












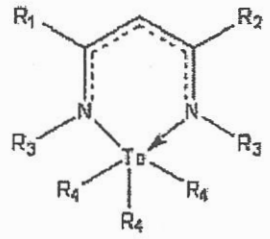
48. The process of claim 46, wherein the contacting is carried out in the presence of a co-reactant selected from the group consisting of: hydrogen, H_2/plasma, amines, imines, hydrazines, silanes, silyl chalcogenides, germanes, ammonia, alkanes, alkenes, and alkynes.

49. The process of any one of claims 1 to 6 and 43, wherein oxygen and/or nitrogen is introduced into the germanium antimony telluride material from N_2O, O_2 or NO.

50. The process of any one of claims 1 to 6 and 43, wherein the organo-tellurium precursor comprises a tellurium diketiminate precursor.

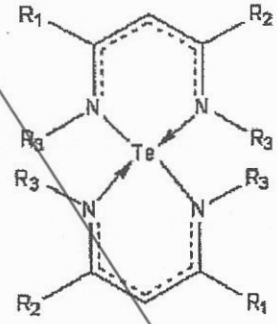
51. The process of any one of claims 1 to 6 and 43, wherein the organo-tellurium precursor comprises a precursor selected from the group consisting of:

tellurium complexes of formulae (I) and (II):



(I)

wherein R_1, R_2 and R_3 they be the same as or different from one another, and each is independently selected from C_1-C_6 alkyl, C_6-C_{10} aryl, silyl and C_1-C_{12} alkylamine (which includes both monoalkylamine as well as dialkylamine); and



(II)

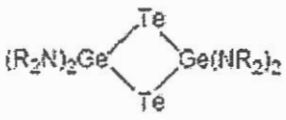
wherein R_1, R_2 and R_3 they be the same as or different from one another, and each is independently selected from C_1-C_6 alkyl, C_6-C_{10} aryl, silyl and C_1-C_{12} alkylamine (which includes both monoalkylamine as well as dialkylamine).

52. The process of any one of claims 1 to 6 and 43, wherein the organo-tellurium precursor comprises a precursor containing tellurium and germanium in the same precursor.

53. The process of claim 52, wherein the precursor comprises a dialkylgermanetellurone.

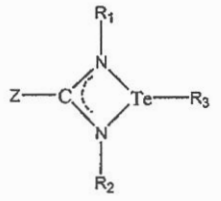
54. The process of claim 52, wherein the precursor comprises a germanium telluride.

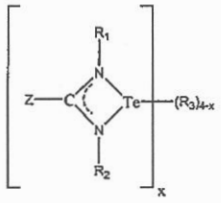
55. The process of claim 54, wherein the germanium telluride has the formula:

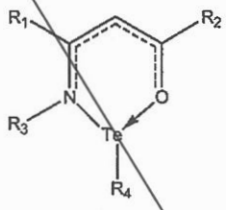


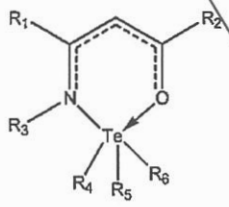
wherein each R may be the same as or different from one another, and is independently selected from H, C_1-C_6 alkyl, C_6-C_{10} aryl, C_3-C_8 cycloalkyl and heteroatom groups.

56. The process of any one of claims 1 to 6 and 43, wherein the organo-tellurium precursor comprises a precursor selected from the group consisting of:









wherein R_1, R_2, R_3, R_4, R_5, R_6 and Z may be the same as or different from one another, and each is independently selected from the group consisting of C_1-C_6 alkyl, C_3-C_8 cycloalkyl, C_6-C_{10} aryl, silyl, alkylsilyl (e.g., trimethylsilyl), hydrogen and halogen, and wherein x is an integer having a value of from 1 to 3.

57. The process of claim 43, wherein the germanium amidinate precursor comprises germanium methyl amidinate.

58. The process of any one of claims 1 to 6 and 43, wherein the contacting is carried out in the presence of ammonia.

59. The process of any of claims 1 to 6 and 43, conducted at temperature below 300°C in the manufacture of a phase change memory structure.

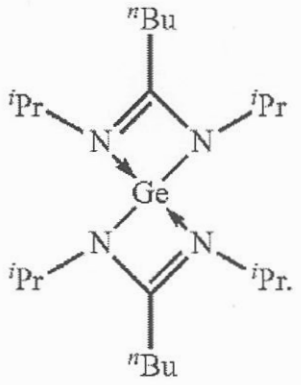
60. The process of claim 59, wherein said contacting is carried out under atomic layer deposition conditions or chemical vapor deposition conditions.

What is claimed is:

1. A method of fabricating a phase-change non-volatile memory device structure including a germanium alloy, said method comprising forming a germanium alloy on a substrate, wherein the germanium component of said germanium alloy is deposited on said substrate by vapor deposition of germanium from a germanium amidinate precursor, wherein the germanium amidinate precursor includes Ge(II) or Ge(IV), and at least one amidinate ligand of the formula [RNCXNR]— wherein each R is independently selected from H, C1-C6 alkyl, C3-C10 cycloalkyl, C6-C13 aryl, and —Si(R')3 wherein each R' is independently selected from C1-C6 alkyl, and X is selected from among H, C1-C6 alkyl, C1-C6 alkoxy, —NR1R2, and —C(R3)3, wherein each of R1, R2 and R3 is independently selected from H, C1-C6 alkyl, C3-C10 cycloalkyl, C6-C13 aryl, and —Si(R4)3 wherein each R4 is independently selected from C1-C6 alkyl, and wherein non-amidinate ligand(s) are selected from alkyl, alkoxy, dialkylamino, hydrido, —Si(R4)3 and halogen groups.

2. The method of claim **1**, wherein the germanium alloy comprises germanium-antimony-tellurium (GST) alloy.

3. The method of claim **1**, wherein the germanium amidinate precursor comprises germanium bis(n-butyl, N,N-diisopropylamidinate),



4. The method of claim **1**, wherein said vapor deposition of germanium is conducted at temperature not exceeding 300° C.

5. The method of claim **2**, wherein the antimony component of said GST alloy is deposited on said substrate by vapor deposition of antimony from an antimony precursor comprising a trialkyl antimony compound or a triamido antimony compound.

6. The method of claim **5**, wherein the antimony precursor comprises a tris-dialkylamido antimony compound.

7. The method of claim **5**, wherein the antimony precursor comprises tris(dimethylamino) antimony.

8. The method of claim **2**, wherein the tellurium component of said GST alloy is deposited on said substrate by vapor deposition of tellurium from a tellurium precursor comprising dialkyl tellurium.

9. The method of claim **8**, wherein the tellurium precursor comprises di-t-butyltellurium.

10. The method of claim **2**, wherein the antimony component of said GST alloy is deposited on said substrate by vapor deposition of antimony from an antimony precursor comprising tris(dimethylamino)antimony, and the tellurium component of said GST alloy is deposited on said substrate by vapor deposition of tellurium from a tellurium precursor comprising di-t-butyltellurium.

11. The method of claim **10**, comprising delivery of said precursors for vapor deposition, in which each of the precursors is delivered separately or in precursor mixture.

12. The method of claim **11**, wherein the tellurium precursor is delivered separately for vapor deposition.

13. The method of claim **1**, wherein the phase-change non-volatile memory device structure includes electrode and dielectric material components.

14. The method of claim **1**, wherein the phase-change non-volatile memory device structure includes an insulating material containing a via within which the GST material is deposited.

15. The method of claim **14**, wherein the insulating material comprises material selected from the group consisting of silicon oxide, silicon nitride, and low k dielectric material.

16. The method of claim **2**, further comprising doping said GST alloy with at least one of silicon and nitrogen.

17. The method of claim **2**, wherein the GST alloy is formed using a hydrogen or ammonia co-reactant.

18. The method of claim **2**, wherein the GST alloy is formed by chemical vapor deposition.

19. The method of claim **2**, wherein the GST alloy is formed by atomic layer deposition.

20. The method of claim **1**, further comprising precursor liquid delivery.

21. The method of claim **20**, wherein said liquid delivery comprises a liquid delivery medium including at least one solvent species selected from the group consisting of alkane solvents, ethers, aryl solvents, amines, imines, guanidines, amidines and hydrazines.

22. The method of claim **2**, further comprising doping the GST alloy to reduce its reset current.