wherein:

A is selected from the group consisting of $–NMe_2$, $-N(R^4)(CH_2)_nN(R^5R^6)$, $-N=C(NR^4R^5)(NR^6R^7)$, and Y;

R^4, R^5, R^6 and R^7 are independently selected from the group consisting of H and an acyclic alkyl group having from 1 to 4 carbon atoms;

Y is selected from the group consisting of aziridinyl, azetidinyl, pyrrolidinyl, piperidinyl, azepanyl, and azepinyl, and Y is bonded to M via a nitrogen atom;

R^3 is a cyclic or acyclic alkyl group having from 1 to 6 carbon atoms;

M is selected from the group consisting of Si, Ge, Sn;

x is an integer from 1 to 3; and

n is an integer from 1 to 4;

with the proviso that when A is $–NMe_2$, R^3 is methyl or ethyl,

c. purging the substrate with purge gas,
d. delivering to said substrate an oxygen source in the gaseous phase,
e. purging the substrate with purge gas,
f. repeating steps b) through e) until a desired thickness of metal oxide has been deposited.

Such compounds may be useful as precursors for metal oxide vapour phase deposition. The compounds of the invention comprise one or more ligands which are strong Lewis bases. Exemplary bases comprise acetates, halides and neutral, nitrogen-containing species with high proton affinity such as phosphazenes, amidines and guanidines.

CLAIMS

What is claimed is:

1. A method of forming a metal oxide film by an atomic layer deposition (ALD) process, the ALD method comprising the steps of:
    a. Providing at least one substrate having functional O-H groups covering the surface,
    b. delivering to said substrate at least one compound of Formula 1 in the gaseous phase;:

$(A)_x$-M-$(OR^3)_{4-x}$

wherein:

A is selected from the group consisting of $–NMe_2$, -$N(R^4)(CH_2)_nN(R^5R^6)$, -$N=C(NR^4R^5)(NR^6R^7)$, and Y;

R^4, R^5, R^6 and R^7 are independently selected from the group consisting of H and an acyclic alkyl group having from 1 to 4 carbon atoms;

Y is selected from the group consisting of aziridinyl, azetidinyl, pyrrolidinyl, piperidinyl, azepanyl, and azepinyl, and Y is bonded to M via a nitrogen atom;

R^3 is a cyclic or acyclic alkyl group having from 1 to 6 carbon atoms;

M is selected from the group consisting of Si, Ge, Sn;

x is an integer from 1 to 3; and

n is an integer from 1 to 4;

with the proviso that when A is $–NMe_2$, R^3 is methyl or ethyl,

    c. purging the substrate with purge gas,
    d. delivering to said substrate an oxygen source in the gaseous phase,
    e. purging the substrate with purge gas,
    f. repeating steps b) through e) until a desired thickness of metal oxide has been deposited.

2. The method of claim 1, wherein M is Si.

3. The method of claim 1, wherein A is selected from the group consisting of tetraethylguanidinyl, dimethylethylenediaminyl, and Y.

4. The method of claim 1, wherein R^3 is an acyclic alkyl group having from 1 to 4 carbon atoms.

5. The method of claim 3 wherein A is pyrrolidinyl, and R^3 is selected from the group consisting of methyl and ethyl.

6. The method of claim 1, wherein the oxygen source is selected from H_2O in gaseous phase, H_2O_2 in gaseous phase, O_2, and O_3.

7. The method of claim 1, wherein A is $–NMe_2$.

8. The method of claim 4, wherein Y is selected from the group consisting of aziridinyl, azetidinyl and pyrrolidinyl.

9. The method of claim 4, wherein R^3 is selected from the group consisting of methyl and ethyl.

10. The method of claim 9, wherein R^3 is a methyl group.

11. The method of claim 1, wherein A is $-N(R^4)(CH_2)_nN(R^5R^6)$ or $-N=C(NR^4R^5)(NR^6R^7)$.

12. The method of claim 11, wherein R^4, R^5, R^6 and R^7 are independently selected from the group consisting of methyl and ethyl.