CLAIMS

1. A method for depositing an organosilica film, the method comprising:

providing a substrate within a reaction chamber;

introducing into the reaction chamber a gaseous composition comprising a hydrido-dimethyl-alkoxysilane having the structure given in Formula (1):

(1) $H(Me)_2SiOR$

wherein R is selected from the group consisting of iso-propyl, sec-butyl, tert-butyl, 2-pentyl, 3-pentyl, 3-methyl-2-butyl, tert-pentyl, cyclopentyl, and cyclohexyl; and

applying energy to the gaseous composition in the reaction chamber to induce a reaction of the hydrido-dimethyl-alkoxysilane and thereby deposit the organosilica film on the substrate.

2. The method of claim 1, wherein the composition comprising the hydrido-dimethyl-alkoxysilane of Formula (1) is substantially free of one or more impurities selected from the group consisting of halide compounds, water, metals, oxygen-containing impurities, nitrogen-containing impurities and combinations thereof.

3. The method of claim 1, wherein the organosilica film has a dielectric constant of from 2.70 to 3.50, an elastic modulus of from 6 to 36 GPa, and an XPS carbon content of from 10 to 36 at. %.

4. The method of claim 1 wherein the gaseous composition comprising hydrido-dimethyl-alkoxysilane is free of a hardening additive.

5. The method of claim 1 which is a chemical vapor deposition method.

6. The method of claim 1 which is a plasma enhanced chemical vapor deposition method.

7. The method of claim 1 wherein the gaseous composition comprising hydrido-dimethyl-alkoxysilane further comprises the at least one oxidant selected from the group consisting of O_2, N_2O, NO, NO_2, CO_2, CO, water, H_2O_2, ozone, alcohols, and combinations thereof.

8. The method of claim 1 wherein the gaseous composition comprising hydrido-dimethyl-alkoxysilane does not comprise an oxidant.

9. The method of claim 1 wherein the reaction chamber during the applying step comprises at least one gas selected from the group consisting of He, Ar, N_2, Kr, Ne, and Xe.

10. The method of claim 9, wherein the reaction chamber during the applying step further comprises at least one oxidant selected from the group consisting of O_2, N_2O, NO, NO_2, CO_2, CO, water, H_2O_2, ozone, alcohols, and combinations thereof.

11. The method of claim 1 wherein the organosilica film has a refractive index (RI) of from 1.3 to 1.7 at 632 nm.

12. The method of claim 1 wherein the organosilica film is deposited at a rate of from 5 nm/min to 400 nm/min.

13. The method of claim 1, wherein the organosilica film has a value of relative bridging methylene ($SiCH_2Si$) density as determined by IR spectrscopy of 10 to 30, and further has a ratio of relative $SiCH_2Si$ Density*/ total carbon (at. % XPS) is greater than 0.65.

14. The method of claim 1, wherein the organosilica film has a value of the leakage current density of less than 1 x 10^{-9} A/cm^2 at an electric field strength greater than or equal to 4 MV/cm.

15. The method of claim 1, wherein R is sec-butyl.

16. A composition when used in a vapor deposition of an organosilica film comprising a hydrido-dimethyl-alkoxysilane having the structure given in Formula (1):

(1) $H(Me)_2SiOR$

wherein R is selected from the group consisting of iso-propyl, sec-butyl, tert-butyl, 2- pentyl, 3-pentyl, 3-methyl-2-butyl, tert-pentyl, cyclopentyl, and cyclohexyl.

17. The composition of claim 16, wherein the composition is substantially free of one or more impurities selected from the group consisting of halide compounds, water, oxygen-containing impurities, nitrogen-containing impurities, and metals.

18. The composition of claim 16, wherein the composition is substantially free of chloride compounds.

19. The composition of claim 18, wherein the chloride compounds, if present, are present at a concentration of 10 ppm or less as measured by IC.

20. The composition of claim 18, wherein the chloride compounds, if present, are present at a concentration of 5 ppm or less as measured by IC.

21. The composition of claim 18, wherein the chloride compounds, if present, are present at a concentration of 1 ppm or less as measured by IC.

22. The composition of claim 16, wherein the composition is substantially free of nitrogen-containing impurities.

23. The composition of claim 22, wherein the nitrogen-containing impurities, if present, are present at a concentration of 1000 ppm or less as measured by GC.

24. The composition of claim 22, wherein the nitrogen-containing impurities, if present, are present at a concentration of 500 ppm or less as measured by GC.

25. The method of claim 1 wherein the organosilica film has a refractive index (RI) of from 1.3 to 1.6 at 632 nm and a nitrogen content of 0.1 at. % or less as measured by XPS or SIMS or RBS.

26. The composition of claim 16 wherein the hydrido-dimethyl-alkoxysilane is selected from the group consisting of dimethyl-iso-propoxysilane, dimethyl-sec-butoxysilane, dimethyl-tert-butoxysilane, dimethyl-2-pentoxysilane, dimethyl-3-pentoxysilane, dimethyl-3-methyl-2-pentoxysilane, dimethyl-tert-pentoxysilane, dimethyl-cyclopentoxysilane, and dimethyl-cyclohexoxysilane.

27. The composition of claim 16, which comprises dimethyl-iso-propoxysilane.

28. The composition of claim 16, which comprises dimethyl-tert-pentoxysilane.

29. The composition of claim 16, which comprises dimethyl-2-pentoxysilane.

30. A compound of dimethyl-sec-butoxysilane when used in a vapor deposition of an organosilica film.

31. A compound of dimethyl-cyclopentoxysilane when used in a vapor deposition of an organosilica film.