CLAIMS

1. A method for making a dense organosilica film with improved mechanical properties, the method comprising the steps of:

providing a substrate within a reaction chamber;

introducing into the reaction chamber a gaseous composition comprising one or more selected from the group consisting of 1-methyl-1-iso-propoxy-silacyclopentane and 1-methyl-1-iso-propoxy-silacyclobutane; and

applying energy to the gaseous composition in the reaction chamber to induce reaction of the gaseous composition and thereby deposit an organosilica film on the substrate, wherein the organosilica film has a dielectric constant of from 2.80 to 3.00 and an elastic modulus of from 11 to 18 GPa;

wherein the gaseous composition comprises O_2 which is introduced during reaction of the gaseous composition at a rate of no greater than 32 sccm.

2. The method of claim 1 wherein the gaseous composition is free of a hardening additive.

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

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

~~5. The method of claim 1 wherein the gaseous composition comprises at least one oxidant selected from the group consisting of O_2, N_2O, NO, NO_2, CO_2, water, H_2O_2, ozone, and combinations thereof.~~

~~6. The method of claim 1 wherein the gaseous composition comprises O2 and is introduced during reaction of the gaseous composition at a rate of no greater than 32 sccm.~~

~~7. The method of claim 1 wherein the gaseous composition does not comprise an oxidant.~~

~~8.~~5. The method of claim 1 wherein the reaction chamber in the applying step comprises at least one gas selected from the group consisting of He, Ar, N_2, Kr, Xe, CO_2, and CO.

~~9.~~6. The method of claim 1 wherein the organosilica film has a refractive index (RI) of from 1.44 to 1.49 at 632 nm and an at. % carbon as measured by XPS of from 25% to 31%.

~~10.~~7. The method of claim 1 wherein the organosilica film is deposited at a rate of from 41 nm/min to 80 nm/min.

~~11.~~8. The method of claim ~~8~~ 1 wherein the organosilica film has a $SiCH_2Si/SiO_x*1E^4$ IR ratio of from 17 to 19.

~~12.~~9. A method for making a dense organosilica film with improved mechanical properties, the method comprising the steps of:

providing a substrate within a reaction chamber;

introducing into the reaction chamber a gaseous composition comprising one or more selected from the group consisting of 1-methyl-1-iso-propoxy-silacyclopentane and 1-methyl-1-iso-propoxy-silacyclobutane; and

applying energy to the gaseous composition in the reaction chamber to induce reaction of the gaseous composition and thereby deposit an organosilica film on the substrate, wherein the organosilica film has a dielectric constant of from 2.80 to 3.10, an elastic modulus of from 11 to 20 GPa, and an at. % carbon of from 12 to 31 as measured by XPS;

wherein the gaseous composition comprises O_2 which is introduced during reaction of the gaseous composition at a rate of no greater than 32 sccm.

~~13.~~10. The method of claim ~~12~~ 9 wherein the gaseous composition is free of a hardening additive.

~~14.~~11. The method of claim ~~12~~ 9 which is a chemical vapor deposition method.

~~15.~~12. The method of claim ~~12~~ 9 which is a plasma enhanced chemical vapor deposition method.

~~16. The method of claim 12 wherein the gaseous composition comprises at least one oxidant selected from the group consisting of O_2, N_2O, NO, NO_2, CO_2, water, H_2O_2, ozone, and combinations thereof.~~

~~17. The method of claim 16 wherein the gaseous composition comprises O2 and is introduced during reaction of the gaseous composition at a rate of no greater than 32 sccm.~~

~~18. The method of claim 12 wherein the gaseous composition does not comprise an oxidant.~~

~~19.~~13. The method of claim ~~12~~ 9 wherein the reaction chamber in the applying step comprises at least one gas selected from the group consisting of He, Ar, N_2, Kr, Xe, CO_2, and CO.

~~20.~~14. The method of claim ~~12~~ 9 wherein the organosilica film has a refractive index (RI) of from 1.443 to 1.488 at 632 nm.

~~21.~~15. The method of claim ~~12~~ 9 wherein the organosilica film is deposited at a rate of from 41 nm/min to 80 nm/min.

~~22.~~16. The method of claim ~~18~~ 9 wherein the organosilica film has a $SiCH_2Si/SiO_x$*$1E^4$ IR ratio of from 17 to 19.

~~23.~~17. A method for making a dense organosilica film with improved mechanical properties, the method comprising the steps of:

providing a substrate within a reaction chamber;

introducing into the reaction chamber a gaseous composition comprising 1-methyl-1-iso-propoxy-silacyclopentane or 1-methyl-1-iso-propoxy-silacyclobutane; and

applying energy to the gaseous composition in the reaction chamber to induce reaction of the gaseous composition and thereby deposit an organosilica film on the substrate, wherein the organosilica film has a dielectric constant of from 2.70 to 3.20 and an elastic modulus of from 11 to 25 GPa;

wherein the gaseous composition comprises O_2 which is introduced during reaction of the gaseous composition at a rate of no greater than 32 sccm.