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OPTICALLY CLEAR ORGANOPOLY-SILOXANE RESINS

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This application relates to tough, thermally stable, optically clear, solvent resistant organopolysiloxane resin materials.

Optically clear, synthetic resinous materials have obtained widespread use in the art. These optically clear, synthetic materials have been used as insulation for electrical and electronic components where it has been desirable to insulate and/or protect the components while at the same time being able to view the components. These synthetic resinous materials have offered certain advantages over glass in that they are relatively easy to handle and can be cast about almost any type of object and can be formed into almost any shape. These materials have also been used as substitutes in optical systems, since they can be cast into the desired lens shape without the necessity for the complicated polishing operations which are necessary for conventional glass lens elements. Synthetic resinous optical elements have been used in equipment such as lenses, telescopes and the like and have also been used in the formation of contact lenses for correcting human vision.

While these prior art optically clear, synthetic resinous materials have had many advantages, they have also had certain disadvantages. Thus, these materials have generally been formed of materials which have little stability at elevated temperatures and thus tend to distort and lose their optical clarity. In addition, these prior art materials have had relatively poor resistance to organic solvents as well as acids and alkalis. Furthermore, these materials have not had the desired abrasion resistance or the high electrical strength or the toughness which have been desired in certain applications.

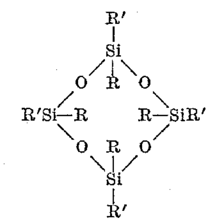
The object of the present invention is to provide an optically clear, tough, solid, thermally stable, solvent resistant, high dielectric strength organopolysiloxane resinous materials.

This, and other objects of my invention, are accomplished by providing an organopolysiloxane resin comprising a substantially equal number of a first class of organocyclotetrasiloxane units and a second class of organocyclotetrasiloxane units, with substantially every unit of said first class being attached to four units of said second class through a silicon-bonded alkylene radical of at least two carbon atoms, with substantially every unit of said second class being attached through its 1- and 5-silicon atoms, respectively, to two units of said first class through said silicon-bonded alkylene radical, the valences of silicon other than the valences satisfied by oxygen in the cyclotetrasiloxane rings and the valences satisfied by silicon-bonded alkylene radicals being satisfied by monovalent hydrocarbon radicals free of olefinic unsaturation.

The organopolysiloxane resins within the scope of the present invention are best understood by their method of preparation. These organopolysiloxane resins are prepared by effecting reaction between two types of organocyclotetrasiloxanes. The first class of organocyclotetrasiloxane is an eight-membered ring of alternate silicon and oxygen atoms, with each silicon atom being attached by a silicon-carbon linkage to a monovalent hydrocarbon radical free of aliphatic unsaturation and with each silicon atom in the cyclotetrasiloxane also being attached to an alkenyl radical by a silicon-carbon linkage or to a hydrogen atom. This class of organocyclotetrasiloxane will

be referred to hereinafter for the sake of brevity as a "tetrafunctional cyclotetrasiloxane" because the cyclotetrasiloxane contains four functional groups, i.e., hydrogen atoms or alkenyl radicals, which are available for reaction. These tetrafunctional cyclotetrasiloxanes can be described by the formula:

(1)

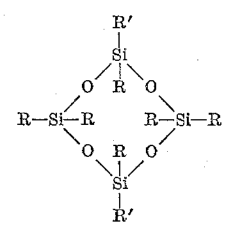


where R represents a monovalent hydrocarbon radical free of aliphatic unsaturation and R′ represents a member selected from the class consisting of hydrogen and alkenyl radicals. Among the groups represented by R in Formula 1 can be mentioned, for example, alkyl radicals, e.g., methyl, ethyl, propyl, butyl, octyl, etc. radicals; aryl radicals, e.g., phenyl, naphthyl, toyly xylyl, etc. radicals; aralkyl radicals, e.g., benzyl, phenylethyl, etc. radicals; cycloalkyl radicals, e.g., cyclohexyl, cycloheptyl, etc. radicals. Preferably, the R radicals are methyl or phenyl radicals or a mixture of methyl and phenyl radicals. Included within the scope of the R′ group of Formula 1 can be mentioned, for example, vinyl, allyl, alpha-methallyl, a pentenyl radical, an octenyl radical, etc. Preferably, where the R′ group is alkenyl, the R′ group represents a vinyl radical.

Included among the tetrafunctional cyclotetrasiloxanes of Formula 1 can be mentioned, for example, 1,3,5,7-tetramethyl-1,3,5,7-tetravinylcyclotetrasiloxane; 1,3,5,7-tetrahydro-1,3,5,7-tetramethylcyclotetrasiloxane; 1,3,5,7-tetraallyl-1,3,5,7-tetraphenylcyclotetrasiloxane; 1,3,5,7-tetrahydro-1,3,5,7-tetraphenylcyclotetrasiloxane; 1,3,5,7-tetravinyl-1,5-dimethyl-3,7-diphenylcyclotetrasiloxane, etc.

The second class of organocyclotetrasiloxane employed as a starting material in the preparation of the organopolysiloxane resins of the present invention is an eight-membered ring containing alternate silicon and oxygen atoms with the 3- and 7-silicon atoms containing two silicon-bonded monovalent hydrocarbon radicals free of aliphatic unsaturation and with the 1- and 5-silicon atoms each containing both one monovalent hydrocarbon radical free of aliphatic unsaturation and one member selected from the class consisting of hydrogen and a silicon-bonded alkenyl radical. For brevity, this second class of organocyclotetrasiloxane will be referred to hereinafter as the "difunctional cyclotetrasiloxane." This cyclotetrasiloxane contains two silicon-bonded hydrogen atoms or silicon-bonded alkenyl radicals per molecule and thus has two points available for further reaction. These difunctional cyclotetrasiloxanes can be represented by the formula:

(2)



where R and R′ are as previously defined. Illustrative of