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SILICONE POTTING COMPOSITIONS COMPRISING MIXTURES OF ORGANOPOLYSILOXANES CONTAINING VINYL GROUPS

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ABSTRACT OF THE DISCLOSURE

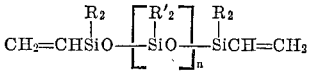
Silicone potting compositions useful in the formation of molds comprise a diorganovinyl chain-stopped diorganopolysiloxane having a viscosity of from about 50,000 to 750,000 centistokes, an organopolysiloxane copolymer of trimethylsiloxane units, methylvinylsiloxane units, and SiO_2 units, a liquid organohydrogenpolysiloxane, and a platinum catalyst. These materials are characterized by unusually high tear strengths.

This invention relates to silicone elastomer compositions which are pourable and which are curable at moderate temperatures to produce a strong silicone rubber.

In the past, pourable silicone compositions have been known which cure to elastomers at room temperature or moderately elevated temperatures. However, any compositions heretofore known meeting these criteria have been generally lacking in the strength which is required for many applications. Thus, any of these compositions which have been both pourable and curable at room temperature have been so weak so that it has been possible to chip or nick the materials with very little force. This has tended to limit the applications of these materials to situations in which a tough, high precision cured silicone rubber was needed, such as in the making of molds for the manufacture of various parts.

The present invention is based on my discovery of new compositions which are pourable, which are curable at room temperature and moderate temperatures, and which cure to an unexpectedly tough silicone elastomer having tear strength greater than about 60 pounds per inch. These compositions comprise, by weight,

(1) 100 parts of a liquid vinyl chain-stopped polysiloxane having the formula:



where R and R′ are monovalent hydrocarbon radicals free of aliphatic unsaturation, with at least 50 mole percent of the R′ groups being methyl and where n has a value sufficient to provide a viscosity of from about 50,000 to 750,000 centistokes at 25° C., preferably from about 50,000 to 150,000, inclusive,

(2) from 20 to 50 parts of an organopolysiloxane copolymer comprising $(R'')_3SiO_{0.5}$ units and SiO_2 units, where R″ is a member selected from the class consisting of vinyl radicals and monovalent hydrocarbon radicals free of aliphatic unsaturation, where the ratio of $(R'')_3SiO_{0.5}$ units to SiO_2 units is from about 0.5:1 to 1:1, and where from about 2.5 to 10 mole percent of the silicon atoms contain silicon-bonded vinyl groups,

(3) from 0 to 200 parts of a finely divided inorganic filler which is non-reinforcing for silicone elastomers,

(4) a platinum catalyst,

(5) an amount of a liquid organohydrogen polysiloxane having the formula:

$$(R)_a(H)_bSiO_{\frac{4-a-b}{2}}$$

sufficient to provide from about 0.5 to 1.0 silicon-bonded hydrogen atom per silicon-bonded vinyl group in the composition, where R is as previously defined, a has a value of from 1.00 to 2.10, b has a value of from about 0.1 to 1.0, and the sum of a plus b is from about 2.00 to 2.67, there being at least two silicon-bonded hydrogen atoms per molecule.

The compositions of the present invention are prepared by mixing in a suitable fashion all of the components described above, plus any additional components such as will be described subsequently, and maintaining the mixture at the temperature at which it is to be cured. The compositions cure at temperatures which vary from room temperature to temperatures of the order of 100° C. or higher, depending upon the particular amount of platinum catalyst present in the composition and depending upon the time which is allowed for the cure. Likewise, the compositions can be prevented from curing by maintaining them at a reduced temperature, such as a temperature of 0° C., in which case all of the components can be kept together for extended periods of time without curing. The compositions can vary from readily flowable liquids to slowly flowing liquids, depending upon the viscosity of the various components employed in the reaction mixture depending upon the amount of filler included in the reaction mixture. Regardless of the flow characteristics of the compositions of the present invention and the proportions of the various ingredients, the compositions cure to a hard, tough silicone elastomer upon maintaining the compositions at the curing temperature for the required amount of time. The compositions which are free of filler are transparent and the compositions containing fillers are translucent or opaque, depending upon the particular filler employed, and the color of the cured product is a function of the filler and any coloring agents added to the compositions.

All of the components of the composition of the present invention are well known in the art. The vinyl chain-stopped organopolysiloxane component (1) is typified by various compositions within the scope of formula (1) where the monovalent hydrocarbon radicals represented by R and R′ include alkyl radicals, e.g., methyl, ethyl, propyl, butyl, octyl, etc. radicals; aryl radicals, e.g., phenyl, tolyl, xylyl, etc. radicals; cycloalkyl radicals, e.g., cyclohexyl, cycloheptyl, etc. radicals; aralkyl radicals, e.g., benzyl, phenylethyl, etc. radicals. In the preferred embodiment of the invention, all of the radicals represented by R and R′ are selected from the class consisting of methyl and phenyl radicals and, in the preferred specific composition, all of the radicals represented by R and R′ are methyl.

The organopolysiloxane copolymer which comprises component (2) of the compositions of this invention have been defined as including R″ groups which can be vinyl or monovalent hydrocarbon radicals free of aliphatic unsaturation, with at least the stated proportion of the R″ groups being vinyl. The R″ groups which are not vinyl are of the same scope as the R and R′ groups of formula (1) and like these groups, in the preferred embodiment of the invention, all of the monovalent hydrocarbon radicals free of aliphatic unsaturation are preferably methyl groups. The vinyl groups can be present either as a portion of the $(R'')_3SiO_{0.5}$ groups or of the $(R'')_2SiO$ groups or can be present in both groups.

In general, the various types of siloxane units in copolymer component (2) are selected so that the ratio of the