United States Patent Office 3,677,981 Patented July 18, 1972

3,677,981

SILICONE ELASTOMERIC COMPOSITIONS AND A METHOD FOR PREPARING SILICONE SPONGE RUBBERS THEREFROM

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No Drawing. Filed May 25, 1970, Ser. No. 40,428
Claims priority, application Japan, June 25, 1969, 44/50,184
Int. Cl. C08j 1/20
U.S. Cl. 260—2.5 S 15 Claims

ABSTRACT OF THE DISCLOSURE

The silicone elastomeric compositions comprise:

(a) from 80 to 99 parts by weight of a diorganopolysiloxane gum having a viscosity of at least 1,000,000 cs. at 25° C., and containing from 0.025 to 0.25 mole percent of vinyl-group containing siloxane units in its molecule;

(b) from 1 to 20 parts by weight of a diorganopolysiloxane having a viscosity of at least 10 cs. at 25° C., and containing at least 10 times as many mole percent of vinyl-group containing siloxane units in its molecule as is contained in one molecule of component (a);

(c) an organohydrogen polysiloxane in an amount such that its Si—H linkages are from 50 to 200 mole percent of the total amount of vinyl groups contained in the above-given components (a) and (b), and containing at least three Si—H linkages in its molecule;

(d) from 20 to 100 parts by weight of a silica filler having a surface area of at least 150 $m.^2/g.$;

(e) from 1 to 10 parts by weight of a blowing agent; and

(f) a catalytic amount of a platinum compound.

When cured at elevated temperature, such elastomeric compositions give silicone sponge rubbers having high tensile strength and an internal structure of continuous foam. The cured products contain no residue of the curing agent. Thus they possess excellent compression set, resilient elasticity, resistance to heat, cold, and steam, electrical properties and flame retardant property. They are therefore useful as insulating materials, soft packing materials, gasket cushion materials, toilet sponge puffs and sponge filters.

SUMMARY OF THE INVENTION

This invention relates to novel silicone elastomeric compositions, and to a method of preparing therefrom silicone sponge rubber having greatly improved properties.

It is well known that silicone sponge rubber can be prepared by curing at an elevated temperature mixtures of a diorganopolysiloxane gum, consisting of methyl groups and a small amount of vinyl groups, a low-molecular siloxane ester or silanol, a filler, a blowing agent and an organic peroxide. The resultant silicone sponge rubber exhibits excellent resistance to heat, cold, and weather. Additionally it possesses superior electrical properties, shock absorption, and resilient elasticity. These properties account for its wide use in various fields as soft-packing materials, gasket cushion materials, and insulating materials. However, its porous structure is comprised mostly of foams which are independent of each other. Moreover, its tensile strength is poor. Therefore, it cannot be employed as sponge filters, toilet sponge puffs or medical sponges, through which a liquid has to pass, or which must be impregnated with a liquid. This

inadequacy is especially felt when the silicone sponge rubber is employed in aircraft or car parts.

An object of the present invention is to provide heat-curable silicone elastomeric compositions, which when cured, will give silicone sponge rubber having a structure of continuous foam which is free from the above-described faults, and which possesses high tensile strength. Another object of the invention is to provide a method for preparing silicone sponge rubber which contains no decomposed residue of the curing agent and which as a result has excellent compression set, resilient elasticity, resistance to heat, cold and steam, superior electrical and flame retardant properties. Still another object of the invention is to provided silicone sponge rubber which is suitable as insulating and soft packing materials, toilet sponge puffs, sponge filters and gasket cushions.

The compositions of the invention consist of (a) from 80 to 99 parts by weight of a diorganopolysiloxane gum having a viscosity of at least 1,000,000 cs. at 25° C., and containing from 0.025 to 0.25 mole percent of vinyl-group containing siloxane units in the molecule; (b) from 1 to 20 parts by weight of diorganopolysiloxane, having a viscosity of at least 10 cs. at 25° C., and containing at least 10 times as many mole percent of vinyl-group containing siloxane units in its molecule as is contained in one molecule of component (a); (c) an organohydrogen polysiloxane in an amount such that its Si—H linkages are from 50 to 200 mole percent of the total amount of vinyl groups contained in the above-given components (a) and (b), and containing at elast three Si—H linkages in its molecule; (d) from 20 to 100 parts by weight of a silica filler having a surface area of at least 150 $m.^2/g.$; (e) from 1 to 10 parts by weight of a blowing agent; and (f) a catalytic amount of a platinum compound.

We have observed that when the above-given organopolysiloxane components (a) and (b), which are principal components of the elastomeric compositions, are heated together with an organohydrogen polysiloxane, a blowing agent and a platinum catalyst, silicone sponge rubber having an unexpectedly high tensile strength and a continuous foam structure can be obtained. In other words, we found, that, to enhance the tensile strength of a silicone sponge rubber, the distribution of the bridging structure contained in the cured elastomer has to be nonuniform. After conducting various experiments, we found out that when a diorganopolysiloxane gum (component (a)), containing in its molecule as little as from 0.025 to 0.25 mole percent of vinyl group-containing siloxane units (CH_2=CHR'SiO) and a diorganopolysiloxane (component (b)) containing at least 10 times as many mole percent of vinyl-group containing siloxane units in its molecule as is contained in one molecule of component (a), assorted in the ratio given above, are cured, together with an organohydrogen polysiloxane (component (c)) having at least three Si—H linkages in its molecule in an amount such that its Si—H linkages are from 50 to 200 mole percent of the total amount of vinyl groups contained in components (a) and (b) the distribution of the vinyl groups in the product will be nonuniform. This causes the position of the bridging structure to also be nonuniform. We further found that if the curing of said elastomeric compositions is carried out by addition reaction in the presence of a platinum compound catalyst, the formation of the foams becomes continuous. Further we found that we could obtain same without fear of the decomposed catalyst remaining in the product.

A more detailed description of the invention follows:

Components (a) and (b) are each composed of a polysiloxane structure, consisting of (i) siloxane units represented by the unit formula: