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3,341,490

BLENDS OF TWO POLYSILOXANE COPOLYMERS WITH SILICA

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ABSTRACT OF THE DISCLOSURE

Blends of siloxane copolymers are disclosed which are useful for making optically clear articles, especially contact lenses.

This invention relates to blends of copolymers. The copolymer blends of this invention are particularly useful in the manufacture of articles wherein optical clarity is desirable. For example, the blends are useful as interlayers in safety glass, in the preparation of pharmaceutical equipment, in the preparation of volumetric apparatus and in the preparation of lenses, especially contact lenses.

More specifically, this invention relates to a blend of copolymers which consists essentially of 60 to 70 parts of a dimethylvinylsilyl endblocked copolymer consisting essentially of about 6 to 9 mol percent of phenylmethylsiloxane units, about 0.1 to 0.2 mol percent of vinylmethylsiloxane units and the balance essentially dimethylsiloxane units and 30 to 40 parts of a dimethylvinylsilyl endblocked copolymer consisting essentially of about 15 to 25 mol percent of methylvinylsiloxane units, about 4 to 6 mol percent of phenylmethylsiloxane units and the balance essentially dimethylsiloxane units, there being a total of 100 parts of the two polymers in the composition, said parts being on a weight basis.

This invention also relates to a blend of copolymers as defined above which contains a reinforcing silica filler.

The invention further relates to vulcanized elastomeric compositions prepared by vulcanizing the blends of copolymers of this invention.

Another facet of this invention are contact lens prepared from the copolymer blends and in particular those containing a reinforcing silica filler. An especially preferred composition for making contact lenses is one which consists essentially of about 65 parts of a dimethylvinyl endblocked copolymer consisting essentially of about 7.5 mol percent of phenylmethylsiloxane units, about 0.14 mol percent of vinylmethylsiloxane units and about 92.36 mol percent of dimethylsiloxane units, about 35 parts of a dimethylvinylsilyl endblocked copolymer consisting essentially of about 20 mol percent methylvinylsiloxane units, about 5 mol percent phenylmethylsiloxane units and about 75 mol percent dimethylsiloxane units, about 3 to 7 parts of a trimethylsilyl treated silica reinforcing filler and about 0.5 to 2.5 parts of an organic peroxide vulcanizing agent, said parts being on a weight basis.

Other objects, advantages and aspects of this invention will be apparent from the following description, examples and claims.

Copolymers of the general type used in making the blends of this invention as well as means for their preparation, are well known to those skilled in the art. Therefore no need exists in occupying space here with information readily available elsewhere in the art. The copolymers used in preparing the blends can be in the form of gums, fluids or combinations of these.

When a filler is employed in the blend of copolymers it is preferably a reinforcing silica filler. A reinforcing silica filler, as those skilled in the art know, is one having a surface area of at least 50 square meters per gram as

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measured by nitrogen adsorption employing the method described in ASTM Special Technical Bulletin No. 51, p. 95 et seq. (1941). This filler can be, for example, a fume silica, silica aerogel or a silica xerogel. A particularly preferred type of reinforcing silica is a trimethylsilyl treated material, especially of the type described in U.S. Patent 3,036,985. Generally, the higher the surface area of the silica is, the more desirable the silica is as a reinforcing filler. Therefore, it is preferable that the silica have a surface area of at least 150 square meters per gram and more preferably above 300 square meters per gram. There is no critical maximum for the surface area which can be 900 square meters per gram or more. Of course, extending fillers such as crushed quartz, diatomaceous earth, calcium carbonate, titanium dioxide and alumina can be incorporated into the copolymer blends, however, the use of this type of filler is not preferred when the compositions of this invention are used to make contact lenses.

The copolymer blends of this invention can be vulcanized by conventional techniques well known to those skilled in the art. For example the blends can be vulcanized by irradiation or with peroxides employing the usual organic peroxide vulcanizing agents. Two organic peroxide vulcanizing agents that have been found to be particularly useful are dicumyl peroxide and tertiary butylperbenzoate.

The blending of the two copolymers to produce the composition of this invention can be done by any suitable technique. Obviously, it is desirable that whatever technique be employed that it result in a reasonably uniform or homogeneous blend of copolymers in order that the best possible results are obtained. The particular blending technique used will be determined by such factors as the blending equipment readily available, the nature of the copolymers being blended (for example whether they are gums, fluids or both) and the ultimate use of the blend.

So far as is known, the proportions of the copolymers in the blend as well as the proportions and type of the siloxane units in each copolymer is critical, within the above limits, if one wishes to have products which are useful in the manufacture of articles having optical clarity.

In order that those skilled in the art can better understand how the present invention can be practiced, the following examples are given by way of illustration and not by way of limitation.

All parts and percents referred to herein are on a weight basis and all viscosities measured at 25° C. unless otherwise specified.

Example 1

A blend of copolymers consisting essentially of (A) 65 parts of a dimethylvinylsilyl endblocked copolymer gum consisting essentially of about 7.5 mol percent phenylmethylsiloxane units, about 0.14 mol percent methylvinylsiloxane units and 92.36 mol percent dimethylsiloxane units, (B) about 35 parts of a dimethylvinylsilyl endblocked copolymer gum consisting essentially of about 15 mol percent methylvinylsiloxane units, about 5 mol percent phenylmethylsiloxane units and about 80 mol percent dimethylsiloxane units and (C) about 5 parts of 2,5-dimethyl-2,5-di(t-butylperoxy)hexane as a vulcanizing agent was prepared. The two copolymer gums were first blended on a two roll mill and then the vulcanizing agent added and milled in.

A second blend of copolymers was prepared which was identical to the first except that 60 parts of (A) and 40 parts of (B) were used.

Lenses were press molded from these blends in a highly polished steel mold for about 15 minutes at 150 °C. and 500 pounds of pressure. The lenses were hot released from