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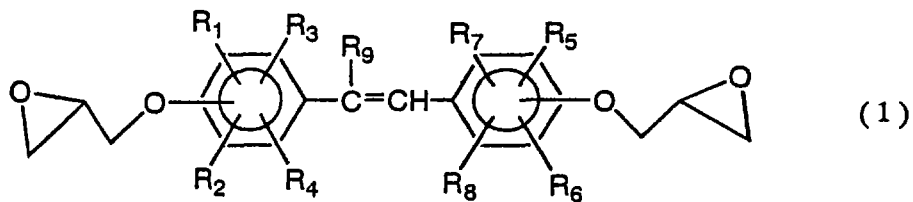
slightly lowers in molding as compared with the polyfunctional epoxy resin, therefore, a method for enhancing Barcole hardness has been desired.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a resin composition which is an excellent material as an epoxy semiconductor encapsulating material, obtained by using an epoxy resin which has excellent molding property and excellent handling property even at room temperature, and a resin encapsulated semiconductor device using the resin composition.

That is, the present invention is an epoxy resin composition comprising:

(A) an epoxy compound represented by the general formula (1):



wherein, R_1 to R_9 represent each independently a hydrogen atom, an acyclic or cyclic alkyl group having 1 to 6 carbon atoms, a substituted or unsubstituted phenyl group or a halogen atom,

(B) a polyfunctional epoxy compound having a functional group number of two or more ~~and~~ selected from a glycidyl ether compound of phenol novolaks or a glycidyl ether compound of bisphenolmethane novolaks, and

(X)

(C) an epoxy curing agent containing a phenolic hydroxyl group,

wherein the proportion of the epoxy compound (A) is from 20% to 99% by weight based on the total weight of the epoxy compounds (A) and (B).

Further, the present invention relates to a resin-encapsulated semiconductor device obtained by encapsulating a semiconductor element using the above epoxy resin composition.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 is a graph showing the relation between the softening point and the mixing ratio of the epoxy resins.

Figure 2 is a graph showing storage stability of the resin composition of Example 9 and Comparative Example 7.

DETAILED DESCRIPTION OF THE INVENTION

Specific examples of the respective substituents R_1 to R_4 of the epoxy resin represented by the general formula (1) used in the present invention include methyl group, ethyl group, propyl group, butyl group, amyl group, hexyl group, cyclohexyl group, phenyl group, tolyl group, xylyl group (including respective isomers), chlorine atom, bromine atom and the like.

The epoxy resin represented by the general formula (I) can be obtained by glycidyl-etherifying stilbenephenols according to a conventional method.

carbon atom on a carbon-carbon double bond of these stilbene compounds with a methyl group are also exemplified. Among these compounds, 2,2'-dihydroxy-3,3',5,5'-tetramethylstilbene, 4,4'-dihydroxy-3,3',5,5'-tetramethylstilbene, 4,4'-dihydroxy-3,3',5,5'-tetramethyl- α -methylstilbene, 4,4'-dihydroxy-3,3'-di-*t*-butyl-5,5'-dimethylstilbene, 4,4'-dihydroxy-3,3'-di-*t*-butyl-6,6'-dimethylstilbene, 2,2'-dihydroxy-3,3'-di-*t*-butyl-6,6'-dimethylstilbene, 2,4'-dihydroxy-3,3'-di-*t*-butyl-6,6'-dimethylstilbene, 3-*t*-butyl-4,4'-dihydroxy-3',5,5'-trimethylstilbene, 3-*t*-butyl-2,4'-dihydroxy-3',5',6-trimethylstilbene and 3-*t*-butyl-4,4'-dihydroxy-3',5',6-trimethylstilbene are particularly preferable from the viewpoints of easiness of synthesis, performances, and price of the raw material.

These epoxy resins are obtained by reacting bisphenols with an epihalohydrin in the presence of an alkaline such as sodium hydroxide and the like. Particularly, when an epoxy resin having high purity is obtained, a reaction in the presence of an aprotic solvent is suitable as described in Japanese Patent Application Laid-Open (JP-A) No. 60-31,517.

In the epoxy resin composition of the present invention, as polyfunctional epoxy compound (B) having a functional group number of two or more, there can be used

selected from a glycidyl ether compound of phenol novolaks or a glycidyl ether compound of triphenylmethane novolaks

(*)

known compounds, and examples thereof include novolak-based epoxy resins which are reaction products of formaldehyde with phenols such as phenol, o-cresol and the like; glycidyl ether compounds derived from three or more-functional phenols such as phloroglycine, tris-(4-hydroxyphenyl)-methane, 1,1,2,2-tetrakis(4-hydroxyphenyl)ethane and the like; glycidyl ether compounds of polyhydric phenols obtained by condensation reaction of phenols with aromatic carbonyl compounds; amine-based epoxy resins derived from p-aminophenol, m-aminophenol, 4-aminomethacresol, 6-aminomethacresol, 4,4'-diaminodiphenylmethane, 3,3'-diaminodiphenylmethane, 4,4'-diaminodiphenyl ether, 3,4'-diaminodiphenyl ether, 1,4-bis(4-aminophenoxy)benzene, 1,4-bis(3-aminophenoxy)benzene, 1,3-bis(4-aminophenoxy)benzene, 1,3-bis(3-aminophenoxy)benzene, 2,2-bis(4-aminophenoxyphenyl)propane, p-phenylenediamine, m-phenylenediamine, 2,4-toluenediamine, 2,6-toluenediamine, p-xylylenediamine, m-xylylenediamine, 1,4-cyclohexanebis(methylamine), 1,3-cyclohexanebis(methylamine) and the like, and one or more of these epoxy resins are used. Among them, novolak-based epoxy resins which are reaction products of formaldehyde with phenols such as phenol, o-cresol and the like, and

glycidyl ether compounds of polyhydric phenols containing a trismethane group obtained by condensation reaction of phenols with aromatic carbonyl compounds, ^{These resins} are particularly preferable in view of heat resistance, easy availability and cost.

The resin composition of the present invention may contain glycidyl ester-based compounds derived from aromatic carboxylic acids such as p-oxybenzoic acid, m-oxybenzoic acid, terephthalic acid, isophthalic acid and the like, such as bisphenol A, bisphenol F, tetramethylbiphenol, hydroquinone, resorcin, 4,4'-thiodi(2,6-dimethylphenol), dihydroxynaphthalene, bis(hydroxyphenyl)dicyclopentane, bis(hydroxyphenyl)menthane and the like; hydantoin-based epoxy compounds derived from 5,5-dimethylhydantoin and the like; alicyclic epoxy resins such as 2,2-bis(3,4-epoxycyclohexyl)propane, 2,2-bis[4-(2,3-epoxypropyl)cyclohexyl]propane, vinylcyclohexene dioxide, 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate and the like; divalent glycidyl ether compounds such as diglycidyl ether compounds and the like derived from dihydric phenols such as N,N-diglycidylaniline and the like, amines or halogenated bisphenols such as tetrabromobisphenol A and the like. Further, the resin composition of the present invention may also contain

cyanate resins such as 2,2-bis(4-cyanatephenyl)propane and the like.

The epoxy resin component of the present invention is obtained by mixing the stilbene-based epoxy compound (A) represented by the general formula (1) with the polyfunctional epoxy compound (B).

The content of the epoxy compound (A) is, for example, from ~~1 to 99%~~ by weight, preferably from 20 to 99% by weight, and ~~more~~ preferably from 30 to 90% by weight based on the total amount of the epoxy compound (A) and the epoxy compound (B). (X) (X)

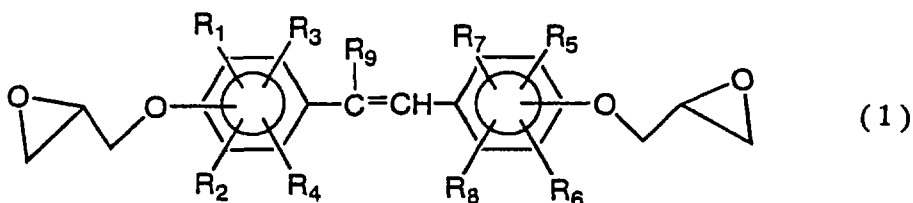
If only the polyfunctional epoxy compound (B) is used, melt viscosity of the resin is high, therefore, when a filler is used in large amount, flowing property of the whole resin composition in heat-melting becomes low, molding property deteriorates, gloss on the surface of the cured molded article disappears, and sometimes, unfilled portion is formed in the cured material. By combining the stilbene-based epoxy compound (A) with the polyfunctional epoxy compound (B), high filling with a filler which is difficult when the polyfunctional epoxy is used alone can be easily accomplished, and in addition, a cured material having excellent molding property is obtained.

When the content of the epoxy compound (A) is, for example, from ~~1~~ to 60% by weight based on the total amount (X)

What is claimed is:

1. An epoxy resin composition comprising:

(A) an epoxy compound represented by the general formula (1):



wherein, R_1 to R_8 represent each independently a hydrogen atom, an acyclic or cyclic alkyl group having 1 to 6 carbon atoms, a substituted or unsubstituted phenyl group or a halogen atom,

(B) a polyfunctional epoxy compound having a functional group number of two or more *and* *amend like page 4*

(C) an epoxy curing agent containing a phenolic hydroxyl group,

wherein the proportion of the epoxy compound (A) is from *20* ~~0.1~~ to 99% by weight based on the total weight of the epoxy compounds (A) and (B).

~~2. The epoxy resin composition according to claim 1, wherein the proportion of the epoxy compound (A) is from 20 to 99% by weight based on the total weight of the epoxy compounds (A) and (B).~~

2 ~~3.~~ The epoxy resin composition according to claim 1, which further comprises an inorganic filler (D) in an amount

of from 25 to 95% by weight based on the weight of the whole resin composition.

- 3 4. The epoxy resin composition according to claim 2,^p wherein the inorganic filler (D) is in an amount of from 50 to 95% by weight based on the weight of the whole resin composition.
- ~~5. The epoxy resin composition according to claim 1 or 2, wherein the polyfunctional epoxy compound (B) is a glycidyl ether compound of phenol novolaks or a glycidyl ether compound of trisphenolmethane novolaks.~~
- 4 6. The epoxy resin composition according to claim 1, or 2, wherein the epoxy curing agent containing a phenolic hydroxyl group (C) is an aralkylphenol resin.
- 5 7. A resin-encapsulated semiconductor device obtained by encapsulating a semiconductor element using the epoxy resin composition of claim 1 or 2.