

Description

The present invention pertains to new compounds containing a plurality of vinylbenzyl groups and a method for their preparation.

5 Monomers having a plurality of vinylbenzyl ether groups have been prepared by Steiner in U.S. 4,116,936 and Orlando et al in U.S. 4,170,711 by a process which comprises reacting a material having a plurality of aromatic hydroxyl groups with a vinylbenzyl halide in the presence of an alkali metal hydroxide and a solvent such as an alcohol. The monomers and oligomers prepared by this process have only a portion of the aromatic hydroxyl groups present converted to vinylbenzyl ether groups. It has been
10 discovered that when the solvent employed is a polar aprotic solvent that more than 95% of the aromatic hydroxyl groups present converted to vinylbenzyl ether groups which results in an improvement in one or more of the properties selected from dielectric constant (before and/or after moisture absorption) or thermal stability. Also, the monomers and oligomers prepared by the process of the present invention do not need further purification such as by recrystallization as described in U.S. 4,116,936.

15 EP-A-0 258 695 discloses polyfunctional vinylbenzyl ethers of polyhydric halogenated phenolic compounds, which can be copolymerized with polycyanate ester compounds to provide copolymers having dielectric constants below 3.

EP-A-0 106 023 describes end-capped polyaryl polyethers, articles made therefrom and process for preparing such polyarylene polyethers.

20 Subject of the present invention is a monomer or oligomer containing a plurality of vinylaryl ether groups represented by the formulas I, II and III according to claim 1.

Preferred embodiments thereof are subject matter of claims 2 to 4.

Further subject matter of the present invention is a method according to claims 5 and 6, and embodiments of these methods are subject matter of claims 7 to 10.

25 A still further subject matter of the present invention is a curable composition according to claims 11 and 12.

One aspect of the present invention pertains to monomers or oligomers containing a plurality of vinylaryl ether groups represented by the following formulas I-III

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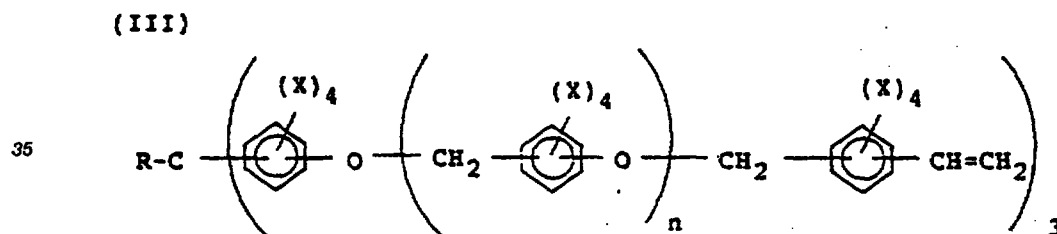
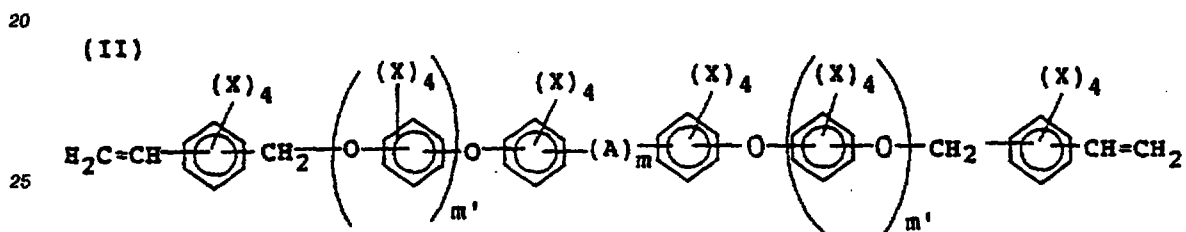
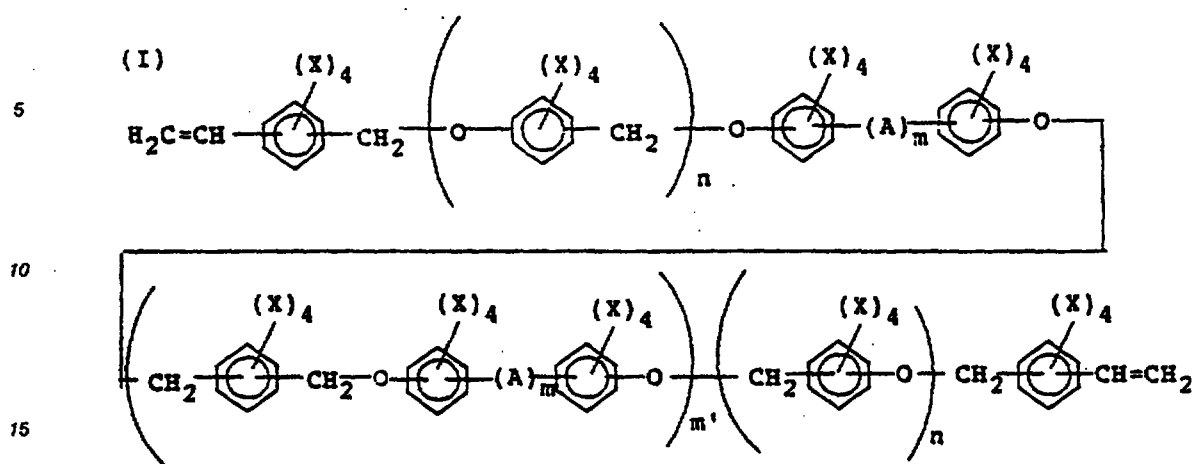
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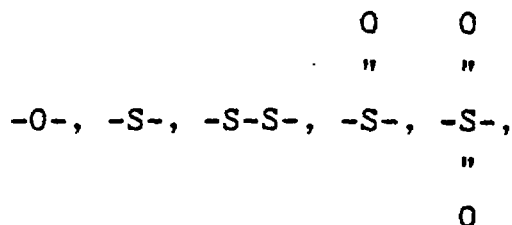
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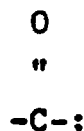
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wherein A is a hydrocarbonyl group having from 1 to 25, preferably from 1 to 15, most preferably from 1 to about 10, carbon atoms,



55 or

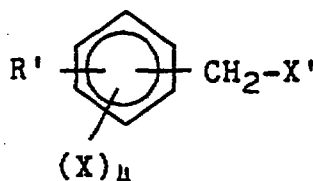


R is hydrogen or a hydrocarbyl group having from 1 to 12, preferably from 1 to 6, most preferably from 1 to 4, carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 12, preferably from 1 to 6, most preferably from 1 to 4, carbon atoms or a halogen atom, preferably bromine; each m independently has a value of zero or 1; m' has a value of from zero to 200, preferably from zero to 50, most preferably from zero to 20 and each n independently has a value of zero or one; with the proviso that when m' and n have a value of zero then A is a dicyclopentadienylene group or a dicyclopentadienylene oligomer group.

Another aspect of the present invention pertains to a method for the preparation of monomers or oligomers as defined above which comprises reacting at least one alkali metal phenoxide of a material containing a plurality of aromatic hydroxyl groups with a vinylbenzyl halide in the presence of a polar aprotic solvent and subsequently recovering therefrom a material wherein more than 95% of the aromatic hydroxyl groups have been converted to vinylbenzyl ether groups.

Another aspect of the present invention pertains to a method for the preparation of monomers or oligomers as defined above which method comprises (A) reacting at least one alkali metal phenoxide of a material containing a plurality of aromatic hydroxyl groups with at least one chain extender material represented by the following formula IV

(IV)



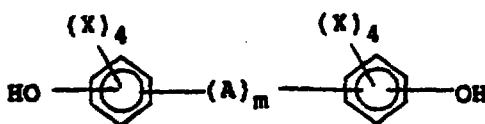
wherein R' is a hydroxyl group or a -CH₂X' group, X is as defined above and X' is a halogen, preferably chlorine or bromine in the presence of an alkali metal hydroxide and a polar aprotic solvent and then (B) reacting the alkali metal phenoxide of the resultant product with a vinylbenzyl halide in the presence of a polar aprotic solvent and subsequently recovering therefrom a material wherein more than 95% of the aromatic hydroxyl groups have been converted to vinylbenzyl ether groups.

The term "hydrocarbyl" as employed herein includes, for example, alkyl, cycloalkyl, cycloalkadienyl and oligomers thereof, aryl, aralkyl, alkaryl and alkenyl. Likewise, the term hydrocarbyloxy as employed herein includes, alkyloxy, cycloalkyloxy, aryloxy, aralkyloxy, alkarylloxy and alkenyloxy.

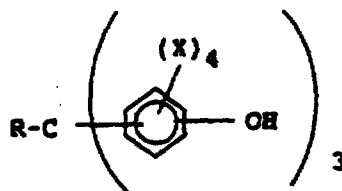
The reaction between the aromatic hydroxyl-containing materials and the vinylbenzyl halide materials or, when appropriate, the benzyl halide extender materials can be conducted at any suitable temperature which will substantially complete the reaction during the time employed. Suitable temperatures include those from -30°C to 100°C, preferably from 0°C to 80°C, most preferably from 15°C to 60°C. Suitable reaction time includes from 0.5 to 20, preferably from 0.5 to 15, most preferably from 0.5 to 6, hours.

Suitable hydroxyl-containing materials which can be employed herein include, for example, those represented by the following formulas V, VI and VII

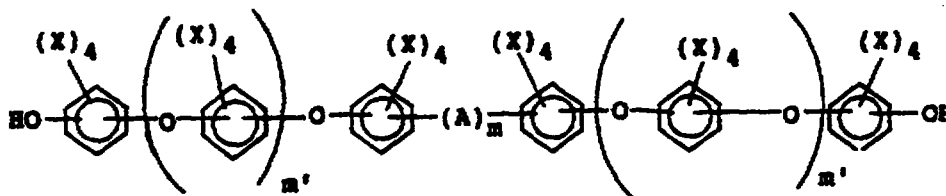
(V)



(VI)



(VII)



wherein A, R, X, m and m' are as defined above. Particularly suitable aromatic hydroxyl-containing materials include, for example, dicyclopentadienyl-bis(2,6-dimethyl phenol), dicyclopentadienyl bis-(ortho-cresol), dicyclopentadienyl bisphenol and combinations thereof. Such polycyclopentadienyl polyphenols and methods for their preparation can be found in U.S. Patent 4,390,680 issued to Donald L. Nelson. Also suitable hydroxyl-containing materials include, for example, resorcinol, bisphenol A, bisphenol F, bisphenol K, bisphenol sulfide, bisphenol sulfone, 3,3',5,5'-tetramethyl bisphenol A, 3,3',5,5'-tetramethyl bisphenol F, 3,3',5,5'-tetramethyl bisphenol K, 3,3',5,5'-tetramethyl bisphenol sulfide, 3,3',5,5'-tetramethyl bisphenol sulfone, 3,3',5,5'-tetramethyl bisphenol, 3,3',5,5'-tetramethyl-2,2',6,6'-tetrabromo bisphenol, 1,1,1-tri-(hydroxyphenyl)alkanes and combinations thereof. Suitable trihydroxyphenyl alkanes and method for their preparation can be found in U.S. Patent 4,394,496 issued to Paul G. Schrader.

Suitable vinylbenzyl halides which can be employed herein include, for example, vinylbenzyl chloride, vinylbenzyl bromide and combinations thereof.

Particularly suitable benzyl halide chain extenders which can be employed herein include, for example, 4-bromomethyl-3,5-dibromo-2,6-dimethyl phenol, 2,4-bis(chloromethyl)mesitylene, 4,6-bis(chloromethyl)-m-xylene, 2,5-bis(chloromethyl)-p-xylene, 1,2-bis(bromomethyl)benzene, 1,3-bis(bromomethyl)benzene, 1,4-bis(bromomethyl)benzene, 1,2-bis(chloromethyl)benzene, 1,3-bis(chloromethyl)benzene, 1,4-bis(chloromethyl)benzene and combinations thereof.

Suitable alkali metal hydroxides which can be employed herein include, for example, sodium hydroxide, potassium hydroxide, lithium hydroxide and combinations thereof.

Suitable polar aprotic solvents which can be employed herein include, for example, glycol ethers, ketones, cyclic ethers, nitriles, sulfones, phosphoramides and combinations thereof. Particularly suitable polar aprotic solvents include, for example, dimethylformamide, dimethylsulfoxide, dimethyl acetamide, N-methyl pyrrolidinone, dioxane, acetonitrile, tetrahydrofuran, ethylene glycol dimethyl ethers, 1,3-dimethoxy propane, 1,2-dimethoxy propane, tetramethylene sulfone, hexamethyl phosphoramide, methyl ethyl ketone, methyl isobutyl ketone, acetone and combinations thereof.

The vinylbenzyl ether-containing materials of the present invention are useful as coating materials, molding resins, particularly electrical molding resins, adhesives and in preparing laminates similar to those made from unsaturated polyesters. Cured products of bromine containing vinylbenzyl terminated monomers and oligomers have high glass transition temperatures (T_g), good thermal stability, low dielectric constant and excellent moisture-resistant properties and are therefore ideal flame retardant materials for use in preparing electrical laminates.

The resins disclosed herein can be combined with a variety of monomers containing unsaturated substituents such as, for example, styrene, α -methyl styrene, divinyl benzene, vinyl toluene, acrylate and methacrylate esters.

The vinylbenzyl ethers of polyphenols can also be blended with bismaleic anhydride imide, bismaleicimide, polypropargyl ethers of polyphenols, polycyanates, such as polyisocyanates of polyphenols, epoxy resins, liquid poly-1,2 or 1,4-butadiene, liquid epoxidized poly 1,2-butadiene, liquid butadiene-acrylonitrile copolymers and combinations thereof. Polyisocyanates of polyphenols include 1,3-dicyanato benzene; 1,4-dicyanato benzene; 1,3,5-tricyanato benzene; 4,4'-dicyanato bisphenol; 2,2-dicyanato-1,1'-binaphthyl; 2,2'-bis-4-cyanato phenyl propane; 4,4'-dicyanato bisphenyl sulfone; 4,4'-dicyanato bisphenyl sulfide; 4,4'-dicyanato-3,3',5,5'-tetramethyl diphenyl ether; 4,4'-dicyanato-3,3',5,5'-tetramethyl diphenyl propane; dicyclopentadienyl bis(4-cyanato benzene); dicyclopentadienyl bis(4-cyanato-3,5-dimethyl benzene) and mixtures thereof.

The vinylbenzyl ethers of polyphenols can also be blended with additive or modifier materials such as, for example, fillers, pigments, dyes, stabilizers, plasticizers, flexibilizers, surfactants, reinforcing materials, fire retardants, diluents and combinations thereof in conventional amounts.

The following examples are illustrative of the present invention but are not to be construed as to limiting the scope thereof in any manner.

EXAMPLE 1

To 1000 ml of a dimethylformamide (DMF) solution containing 282 g (0.75 mole) of dicyclopentadienyl-bis-(2,6-dimethyl phenol) in a reaction vessel equipped with a temperature control and indicating means, a means for stirring, cooling condenser and addition funnel was added 90 g (2.25 mole) sodium hydroxide at room temperature (25°C). The mixture was stirred under a nitrogen atmosphere for 4 hours at 40° to 45°C. The mixture turned dark green in color when the formation of the sodium phenoxides was completed. The solution was then cooled to 25°C and 275 g of vinylbenzyl chloride (1.8 mole of a 60/40 percent by weight mixture of the m/p-isomers) was slowly added at 25° to 30°C over a period of 90 minutes. After completion of the addition, the mixture was maintained at a temperature of 35°C for 4 hours after which the solution turned blue in color. After maintaining the temperature at 45°C for 2 hours, the reaction mixture was cooled to room temperature and dry ice was added to neutralize any excess base. The DMF was removed by means of a rotating evaporator at 70°C to 80°C and a 10 mm Hg (1.33 MPa) vacuum. Then 1000 ml of a 27/75 percent by weight mixture of toluene/methyl ethyl ketone was added to the syrupy residue. The solution was washed with 120 to 200 ml of water several times until the pH of the material was 7. The organic layer was separated and concentrated under a 5 mm to 10 mm (0.67 to 1.33 MPa) vacuum at a temperature of from 60°C to 80°C. The 390 g of product obtained corresponded to a yield of 90% based on the dicyclopentadienyl-bis-(2,6-dimethyl phenol) without need for further purification. Infrared spectrum showed no residual phenolic hydroxyl groups remaining and chemical and ultraviolet (u.v.) analyses indicated that more than 99.9% conversion of the phenolic hydroxyl groups was achieved. The structure was confirmed by nuclear magnetic resonance (NMR) analysis to be the bis(vinylbenzyl) ethers of dicyclopentadienyl-bis-(2,6-dimethyl phenol).

Castings were made by heating the above prepared thermally reactive oligomers to a temperature of from 60°C to 80°C until completely melted, degassing at a temperature of less than 80°C under less than 5 mm Hg (0.67 MPa) vacuum to remove entrapped air and then pouring into a preheated (100°C) mold. The filled molds were heated at 120°C to 130°C for 1 hour, 170°C to 185°C for 2 hours and finally at 210°C to 220°C for 2 hours. The cured resin had a Tg of 210°C (by TMA) and 240°C (by DMA). The properties of the cured resin are given in Table I.

The samples were tested employing the following procedures.

THERMAL TESTS

Glass transition temperatures and other thermal data were determined by using a Dupont 943 Thermo Mechanical Analyzer (TMA) and a Dupont 982 Dynamic Mechanical Analyzer (DMA) with a Dupont 1090 Thermal Analyzer.

Thermogravimetric analysis was conducted on a Perkin-Elmer TGS-2 system. The samples (approximately 10 mg) were heated at 10°C/min. in a steady nitrogen stream of 35 cm³/min. The isothermal weight loss in air after 250 hours at 250°C was based upon the number obtained from a 1" x 2" x 1/8" (25.4 mm x 50.8 mm x 3.175 mm) coupon.

MOISTURE RESISTANCE

The weight gain due to moisture absorption was measured periodically at room temperature after immersing the clear castings into boiling water at 100 °C. The weight gain is based upon the average number obtained from three 1" x 2" x 1/8" (25.4 mm x 50.8 mm x 3.175 mm) coupons. The water on the surfaces of the coupons was carefully wiped off prior to weighing.

DIELECTRIC CONSTANT

The dielectric constants were obtained from 3" x 3" x 1/8" (76.2 mm x 76.2 mm x 3.175 mm) coupons measured with a Gen Rad 1689 bridge and a LD-3 cell.

COMPARATIVE EXPERIMENT A

The solvent disclosed in U.S. 4,116,936 was employed to prepare the product produced in Example 1. Thus, 94 g (0.25 mole) of dicyclopentadienyl-bis-o-cresol and 91.6 g (0.6 mole) of vinylbenzyl chloride, a 60/40 percent by weight mixture of the m-/p-isomers, were dissolved in 150 ml of acetone. The solution was heated to reflux and a solution of 49 g (0.75 mole) of potassium hydroxide (86%) in 100 ml of methanol was added over a period of 30 minutes. The mixture was refluxed for an additional hour. An additional 150 ml of acetone was added and the solution filtered to remove the precipitated potassium chloride. After adding 0.05 g of hydroquinone, the solution was evaporated to dryness on a rotating evaporator at 70 °C under a 5 mm to 10 mm (0.67 to 1.33 MPa) vacuum. The viscous residual oil was worked up as described in Example 1 above. The resultant product was 119 g (76% yield based on dicyclopentadienyl bis-o-cresol) of bis-(vinylbenzyl)-ether of dicyclopentadienyl-bis-o-cresol with only 94% of the phenolic hydroxyl groups converted as determined by chemical and u.v. analysis. Infrared spectrum showed the broad absorption band of residual phenolic hydroxyl groups appearing at 3400 to 3500 cm⁻¹. The product was cured as in Example 1 and the results are given in Table I.

EXAMPLE 2

The same procedure of Example 1 was employed by reacting 270g (0.78 mole) of dicyclopentadienyl-bis(ortho-cresol) in 1000 ml DMF with 93 g (2.33 mole) of sodium hydroxide at 40 °C for 4 hours. The same color change was observed when 286 g (1.87 mole) of vinylbenzyl chloride was added at 30 °C. After work-up as in Example 1, 480 g of bis-vinylbenzyl ethers of dicyclopentadienyl-bis(o-cresol) was obtained which corresponded to a yield of 87% based on dicyclopentadienyl-bis(o-cresol) without further purification. Infrared (IR) spectrum showed no residual phenolic hydroxyl groups remaining and chemical and u.v. analyses indicated that approximately 99.9% conversion of the phenolic hydroxyl groups was achieved. The structure was confirmed by NMR analysis as the bis(vinylbenzyl) ethers of dicyclopentadienyl-bis(o-cresol). The product was cured as in Example 1 and the results are reported in Table I.

TABLE I

5	<u>Property</u>	<u>Example 1</u>	<u>Comp. Expt.</u> <u>A</u>	<u>Example 2</u>
	<u>BEFORE CURING</u>			
	Gel Time @ 175°C, sec.	360-420	300-360	300-360
10	Exotherm			
	Initial, °C	180	180	170
	Maximum, °C	220	220	220
	<u>AFTER CURING</u>			
15	Thermal Stability			
	Temp. required to obtain 5% wt. loss, °C	415	355	395
	Wt. loss after aging at 250°C for 250 hrs. in air, %	1.66	N.D. ³	2.60
20	Moisture pick-up after 200 hrs in boiling water at 100°C, %	0.3	N.D. ³	0.5
25	Dielectric Constant ¹ Frequency, dry/wet ²			
	1000 Hz	2.713/2.860	2.863/3.009	2.820/N.D.
	2000 Hz	2.711/2.854	2.861/3.007	2.816/N.D.
30	5000 Hz	2.709/2.851	2.859/3.004	2.812/N.D.
	10000 Hz	2.705/2.849	2.857/3.001	2.807/N.D.
	20000 Hz	2.697/2.837	2.855/2.999	2.797/N.D.
	50000 Hz	2.699/2.838	2.851/2.994	2.798/N.D.
	100000 Hz	2.686/2.827	2.848/2.988	2.784/N.D.
35	Dissipation Factor ¹ Frequency, dry/wet ²			
	1000 Hz	.00167/.00217	.00149/.00170	.00265/N.D.
	2000 Hz	.00167/.00212	.00150/.00183	.00259/N.D.
	5000 Hz	.00165/.00217	.00161/.00205	.00267/N.D.
40	10000 Hz	.00176/.00240	.00180/.00241	.00273/N.D.
	20000 Hz	.00196/.00277	.00206/.00302	.00284/N.D.
	50000 Hz	.00248/.00370	.00262/.00425	.00310/N.D.
	100000 Hz	.00289/.00460	.00313/.00552	.00343/N.D.

45 ¹Dielectric constant and dissipation factor were measured at room temperature.

²This property was determined after 200 hours in 100°C boiling water.

50 ³This property was not determined.

COMPARATIVE EXPERIMENT B

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The solvent disclosed in U.S. 4,116,936 was employed to prepare the product produced in Example 2. Thus, 65 g(0.187) mole of dicyclopentadienyl-bis-o-cresol and 71 g (0.467 mole) of vinylbenzyl chloride, a 60/40 percent by weight mixture of the m-/p- isomers, were dissolved in 200 ml of acetone. The solution

was heated to reflux and a solution of 36 g of potassium hydroxide (86%) in 115 ml of methanol was added over a period of 30 minutes. The mixture was refluxed for an additional hour. An additional 200 ml of acetone was added and the solution filtered to remove the precipitated potassium chloride. After adding 0.05 g of hydroquinone, the solution was evaporated to dryness on a rotating evaporator at 70 °C under a 5 mm to 10 mm Hg (0.67 to 1.33 MPa) vacuum. The viscous residual oil was worked up as described in Example 1 above. The resultant product was 80 g (77% yield based on dicyclopentadienyl bis-o-cresol) of bis-vinylbenzyl ether of dicyclopentadienyl bis-o-cresol with only 91% of the phenolic hydroxyl groups converted as determined by chemical and u.v. analysis.

10 EXAMPLE 3

A mixture containing 30 parts of divinyl benzene and 70 parts by weight of the divinylbenzyl ethers of dicyclopentadienyl bis(2,6-dimethyl phenol) prepared as in Example 1 was polymerized at 210 °C to 220 °C for 2 hours. The product was a tough clear resin. This product is designated as Sample 1. The dielectric constant and dissipation factor are given in Table II.

The product of Example 2 was copolymerized with divinyl benzene by heating to a temperature of from 60 °C to 80 °C until completely melted, degassing at less than 80 °C under a less than 5 mm Hg. (0.67 MPa) vacuum to remove entrapped air and then pouring into a preheated (100 °C) mold. The filled molds were heated at 120 °C to 130 °C for 1 hour, 170 °C to 185 °C for 2 hours and finally at 210 °C to 220 °C for 2 hours. This product is designated as Sample 2. The dielectric constant and dissipation factor are given in Table II.

25 TABLE II

	<u>Sample 1</u>	<u>Sample 2</u>
30 Dielectric Constant Frequency,		
1000 Hz	2.692	2.710
10000 Hz	2.683	2.701
100000 Hz	2.664	2.682
35 Dissipation Factor Frequency,		
1000 Hz	0.00192	0.00166
40 10000 Hz	0.00188	0.00184
100000 Hz	0.00241	0.00229

45 EXAMPLE 4

EXAMPLE 4

50 In a similar manner to Example 1, 51 g (0.2 mole) of methylene bis(2,6-dimethyl phenol) was reacted with 64 g (0.42 mole) of vinylbenzyl chloride in the presence of 18 g (0.44 mole) of sodium hydroxide and 150 g of di-methylformamide. There was obtained 72 g of viscous product. The structure was confirmed by NMR and IR analysis as being the bis(vinylbenzyl) ethers of methylene bis(2,6-dimethyl phenol). The oligomer was cured at 120 °C to 130 °C for 1 hour, 175 °C for 1 hour, 200 °C for 2 hours and finally 55 230 °C for 3 hours. The properties of the product before and after curing are given in Table III.

TABLE IIIBEFORE CURING

5	Gel Time @ 175°C, sec.	540
	Exotherm	
	Initial, °C	180
10	Maximum, °C	220-230

AFTER CURING

15	Thermal Stability Temp. required to obtain 5% wt. loss, °C	375
20	Wt. loss after aging at 250°C for 250 hrs. in air, %	3.44
25	Moisture pick-up after 100 hrs in boiling water at 100°C, %	0.4

EXAMPLE 5

35 The procedure of Example 1 was repeated except that 3,3',5,5'-tetramethyl-2,2',6,6'-
 tetrabromobisphenol (1), 3,3',5,5'-tetramethyl-2,2',6-tribromobisphenol (2), were employed instead of the
 dicyclopentadienyl bis-(2,6-dimethyl phenol). The corresponding products had no residual phenolic hydroxyl
 groups as determined by IR analysis. The products were cured as in Example 1 and their thermostabilities
 were compared with that of bis(vinylbenzyl) ethers of tetrabromobisphenol A as described in U.S. 4,116,936.
 40 Temperature required to obtain a 5% wt. loss and the weight loss after aging at 250° C for 250 hours in air
 are listed in Table IV.

TABLE IV
Thermal Stability of Bromine Containing Vinyl Benzyl-Terminated Monomers

<u>Structure</u>	<u>Temperature at 5% weight loss in N₂</u>	<u>% Weight loss at 250°C</u>			<u>Dielectric Constant at 10³ Hz/R.T.</u>	<u>% wt. Gain through 200 hours in 100°C H₂O</u>
		<u>100 hours</u>	<u>150 hours</u>	<u>200 hours</u>		
(1)	380°C	1.45	3.02	3.89	2.8	0.3
(2)	385°C	1.54	8.70	12.81	2.9	0.5
(4)	315°C	35.86	36.85	38.29	-	-

Claims

Claims for the following Contracting States : BE, CH, DE, FR, GB, IT, LI, NL, SE

1. A monomer or oligomer containing a plurality of vinylaryl ether groups represented by the following formulas I, II or III

TABLE IV
Thermal Stability of Bromine Containing Vinyl Benzyl-Terminated Monomers

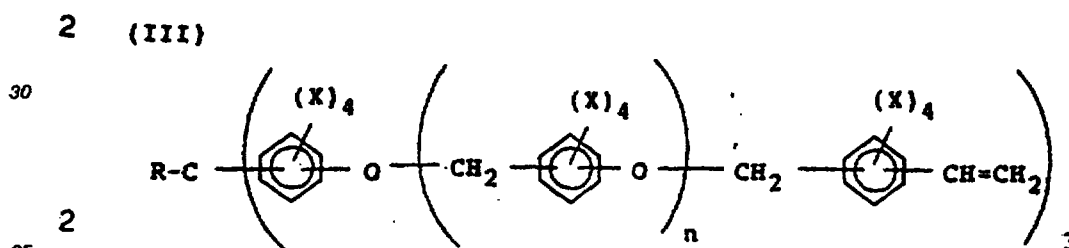
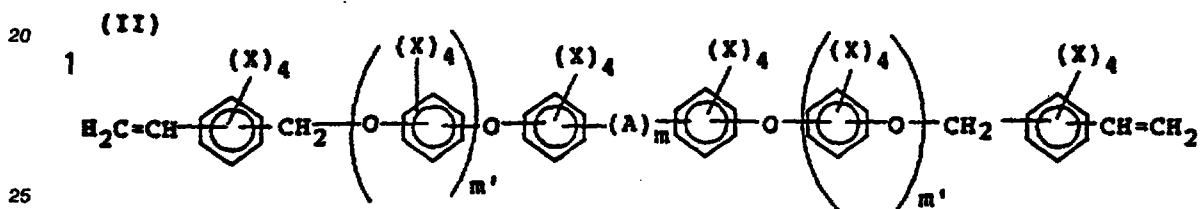
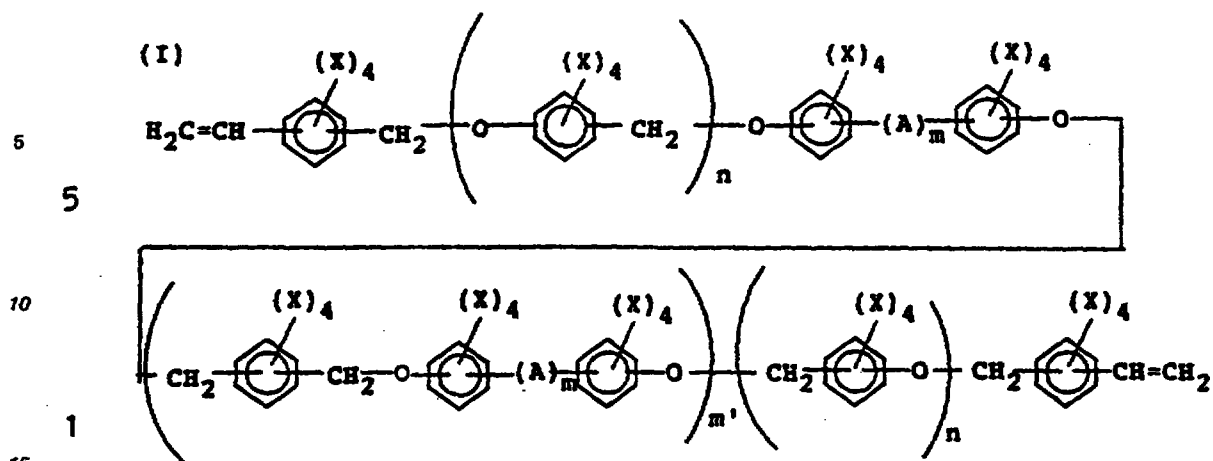
Structure	Temperature at 50 weight loss in N ₂	Weight loss at 250°C			Dielectric Constant at 10 ³ Hz/R.T.	wt. Gain through 200 hours in 100°C H ₂ O
		100 hours	150 hours	200 hours		
(1)	380°C	1.45	3.02	3.89	2.8	0.3
(2)	385°C	1.54	8.70	12.81	2.9	0.5
(4)	315°C	35.86	36.85	38.29	-	-

Claims

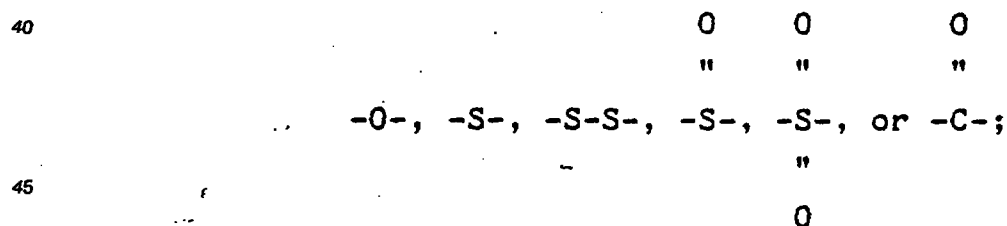
Claims for the following Contracting States : BE, CH, DE, FR, GB, IT, LI, NL, SE

1. A monomer or oligomer containing a plurality of vinylaryl ether groups represented by the following formulas I, II or III





wherein A is a hydrocarbyl group having from 1 to 25 carbon atoms,



R is hydrogen or a hydrocarbyl group having from 1 to 12 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 12 carbon atoms or a halogen atom; m' has a value of from zero to 200; each m and n independently has a value of zero or one; with the proviso that when m' and n have a value of zero, then A is a dicyclopentadienylene group or a dicyclopentadienylene oligomer group.

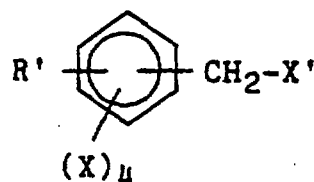
2. A monomer or oligomer as claimed in Claim 1 wherein A is a hydrocarbyl group having from 1 to 15 carbon atoms; R is hydrogen or a hydrocarbyl group having from 1 to 6 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 6 carbon atoms or a halogen atom; each m and n independently has a value of zero or 1; and m' has a value of from zero to



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3. A monomer or oligomer as claimed in Claim 1 wherein A is a hydrocarbyl group having from 1 to 10 carbon atoms; R is hydrogen or a hydrocarbyl group having from 1 to 4 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 4 carbon atoms or a halogen atom; and m' has a value of from zero to 20.
4. A monomer or oligomer as claimed in Claim 1 wherein the monomer or oligomer is selected from the group consisting of the bis(vinylbenzyl) ether of dicyclopentadienyl bis(2,6-dimethyl phenol), bis(vinylbenzyl) ether of dicyclopentadienyl bis(o-cresol).
5. A method for the preparation of a monomer or oligomer as claimed in any of claims 1 to 4 which comprises reacting at least one alkali metal phenoxide of a material containing a plurality of aromatic hydroxyl groups with a vinylbenzyl halide in the presence of a polar aprotic solvent and subsequently recovering therefrom a material wherein more than 95% of the aromatic hydroxyl groups have been converted to vinylbenzyl ether groups.
6. A method for the preparation of a monomer or oligomer as claimed in any of claims 1 to 4 which comprises (A) reacting at least one alkali metal phenoxide of a material containing a plurality of aromatic hydroxyl groups with at least one chain extender material represented by the following formula IV

(IV)

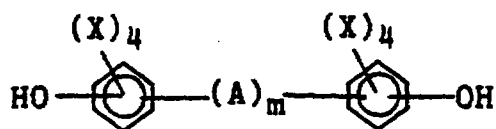


wherein R' is a hydroxyl group or a -CH₂X' group; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 12 carbon atoms or a halogen atom; and X' is a halogen; in the presence of a polar aprotic solvent and then (B) reacting the alkali metal phenoxide of the resultant product with a vinylbenzyl halide in the presence of a polar aprotic solvent and subsequently recovering therefrom a material wherein more than 95% of the aromatic hydroxyl groups have been converted to vinylbenzyl ether groups.

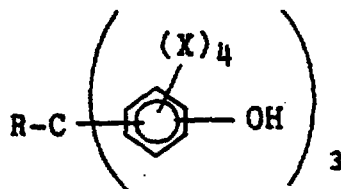
7. A method as claimed in Claim 5 or Claim 6 wherein
 (a) said material containing a plurality of aromatic hydroxyl groups is a material represented by the following formulas V, VI or VII



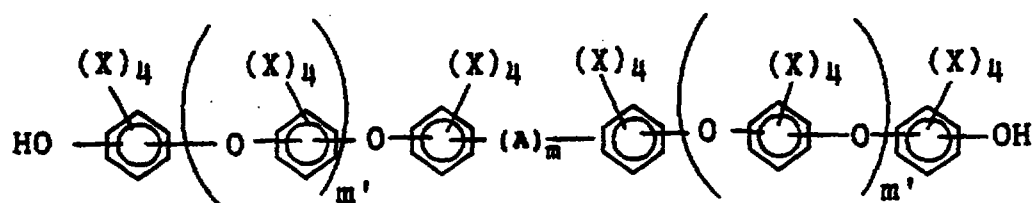
(V)



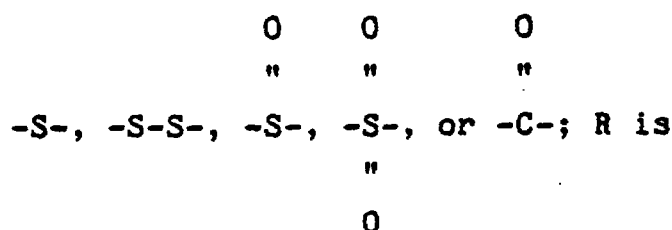
(VI)



(VII)



wherein A is a hydrocarbyl group having from 1 to 25 carbon atoms, -O-,



hydrogen or a hydrocarbyl group having from 1 to 12 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 12 carbon atoms or a halogen atom; each independently has a value of zero or 1; and m' has a value of from zero to 200;

(b) said extender material is 4-bromomethyl-3,5-dibromo-2,6-dimethyl phenol, 2,4-bis(chloromethyl)-mesitylene, 1,2-bis(bromomethyl)benzene, 1,3-bis(bromomethyl)benzene, 1,4-bis(bromo-methyl)benzene, 1,2-bis(chloromethyl)benzene, 1,3-bis(chloromethyl)benzene, 1,4-bis(chloromethyl)-benzene, 4,6-bis(chloromethyl)-m-xylene, 2,5-bis(chloromethyl)-p-xylene, and combinations thereof;

(c) said vinylbenzyl halide is vinylbenzyl chloride or vinylbenzyl bromide; and

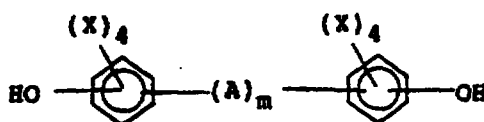
(d) said polar aprotic solvent is dimethylformamide, dimethyl acetamide, dimethylsulfoxide, N-methyl pyrrolidinone, dioxane, acetonitrile, tetrahydrofuran, ethylene glycol dimethyl ether, 1,2-dimethoxy propane, tetramethylene sulfone, hexamethyl phosphoramidate, methyl ethyl ketone, methyl isobutyl ketone, acetone or mixtures thereof.

8. A method as claimed in Claim 5 or 6 wherein

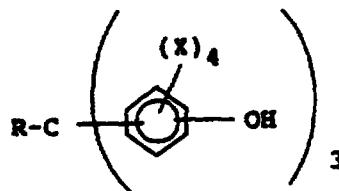
(a) said material containing a plurality of aromatic hydroxyl groups is a material represented by the following formulas V, VI or VII



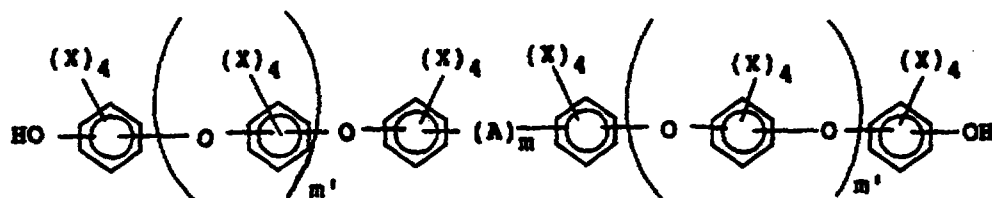
(V)



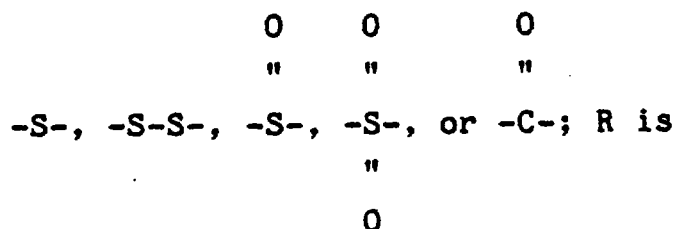
(VI)



(VII)



wherein A is a hydrocarbyl group having from 1 to 15 carbon atoms, -O-,



hydrogen or a hydrocarbyl group having from 1 to 6 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 6 carbon atoms or a halogen atom, preferably bromine; each m independently has a value of zero or 1; and m' has a value of from zero to 50;

(b) said extender material is 4-bromomethyl-3,5-dibromo-2,6-dimethyl phenol, 1,2-bis(bromomethyl)benzene, 1,3-bis(bromomethyl)benzene, 1,4-bis(bromomethyl)benzene, 1,2-bis(chloromethyl)benzene, 1,3-bis(chloromethyl)benzene, 1,4-bis(chloromethyl)benzene, 2,4-bis(chloromethyl)mesitylene, 4,6-bis(chloromethyl)-m-xylene, 2,5-bis(chloromethyl)-p-xylene, and combinations thereof;

(c) said vinylbenzyl halide is vinylbenzyl chloride or vinylbenzyl bromide; and

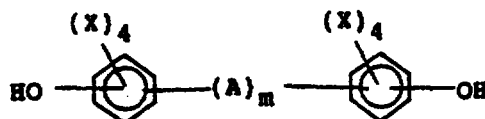
(d) said polar aprotic solvent is dimethylformamide, dimethyl acetamide, dimethylsulfoxide, N-methyl pyrrolidinone, dioxane, acetonitrile, tetrahydrofuran, ethylene glycol dimethyl ether, 1,2-dimethoxy propane, tetramethylene sulfone, hexamethyl phosphoramide, methyl ethyl ketone, methyl isobutyl ketone, acetone or mixtures thereof.

9. A method as claimed in Claim 5 or Claim 6 wherein

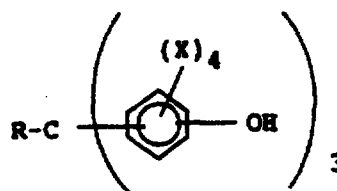
(a) said material containing a plurality of aromatic hydroxyl groups is a material represented by the following formulas V, VI or VII



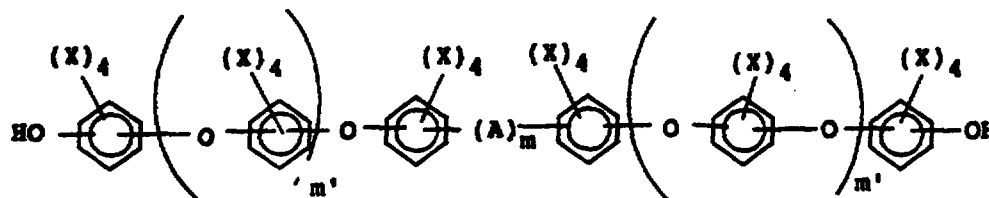
(V)



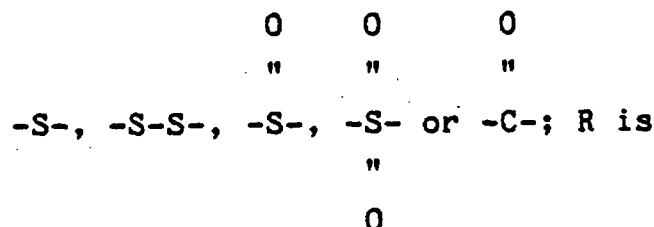
(VI)



(VII)



wherein A is a hydrocarbyl group having from 1 to 10 carbon atoms, -O-,



hydrogen or a hydrocarbyl group having from 1 to 4 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 4 carbon atoms or a halogen atom, preferably bromine; each m independently has a value of zero or 1; and m' has a value of from zero to 20;

(b) said extender material is 4-bromomethyl-3,5-dibromo-2,6-dimethyl phenol, 1,2-bis(bromomethyl)benzene, 1,3-bis(bromomethyl)benzene, 1,4-bis(bromomethyl)benzene, 1,2-bis(chloromethyl)benzene, 1,3-bis(chloromethyl)benzene, 1,4-bis(chloromethyl)benzene, 2,4-bis(chloromethyl)mesitylene, 4,6-bis(chloromethyl)-m-xylene, 2,5-bis(chloromethyl)-p-xylene, and combinations thereof;

(c) said vinylbenzyl halide is vinylbenzyl chloride or vinylbenzyl bromide; and

(d) said polar aprotic solvent is dimethylformamide, dimethylacetamide, dimethylsulfoxide, N-methylpyrrolidinone, dioxane, acetonitrile, tetrahydrofuran, ethylene glycol dimethyl ether, 1,2-dimethoxypropane, tetramethylene sulfone, hexamethyl phosphoramide, methyl ethyl ketone, methyl isobutyl ketone, acetone or mixtures thereof.

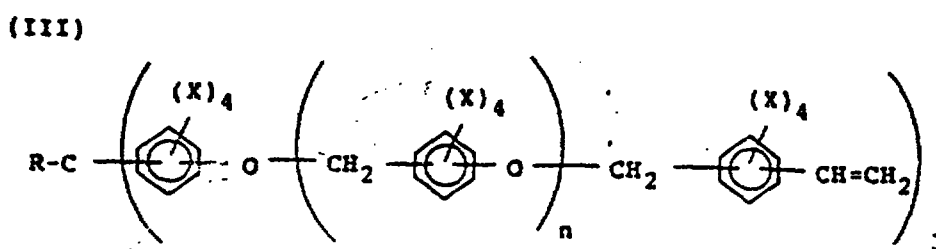
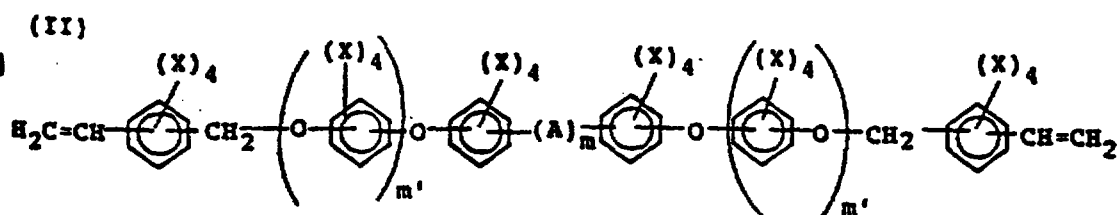
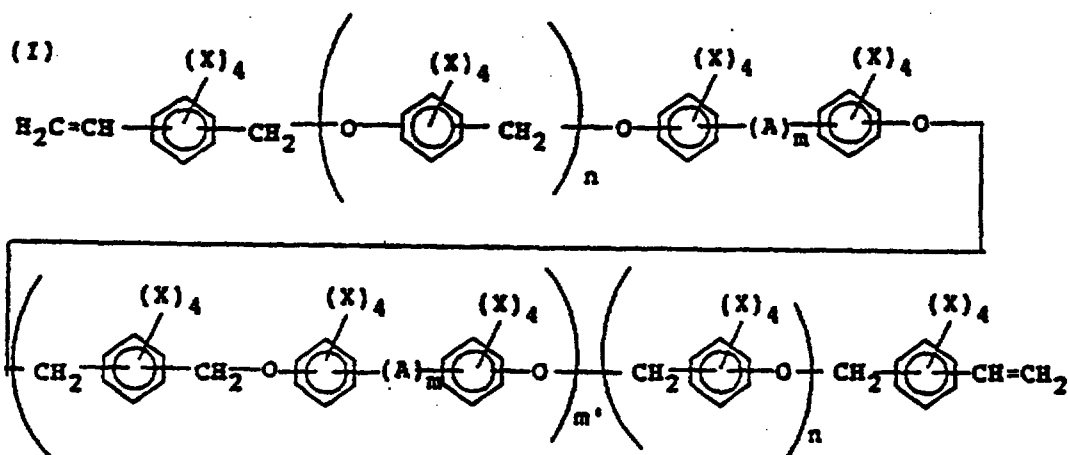
10. A method as claimed in any one of Claims 5 to 9 wherein the reaction is conducted at (1) a temperature of from -30°C to 100°C for 0.5 to 20 hours, (2) a temperature of from 0°C to 80°C for 0.5 to 15 hours, or (3) a temperature of from 15°C to 60°C for 0.5 to 6 hours.



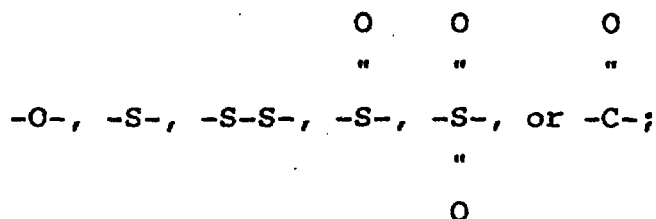
11. A curable composition comprising a monomer or an oligomer as claimed in any one of Claims 1 to 3.
12. A curable composition according to Claim 11 further comprising a curable resin selected from the group consisting of bismaleicimide, polycyanates of polyphenols, polypropargyl ethers of polyphenols, epoxides and mixtures thereof.

Claims for the following Contracting States : AT, ES

1. A method for the preparation of a monomer or oligomer containing a plurality of vinylaryl ether groups represented by the following formulas I, II or III

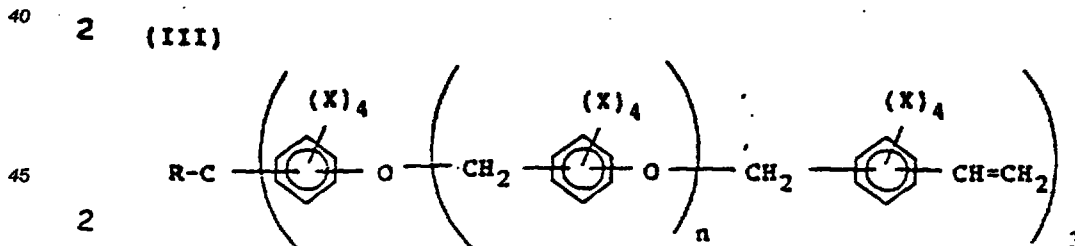
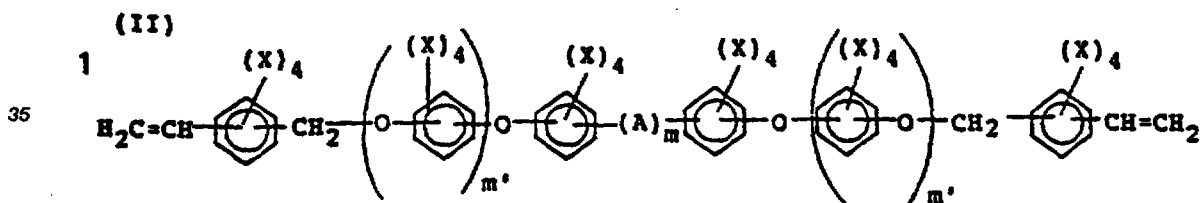
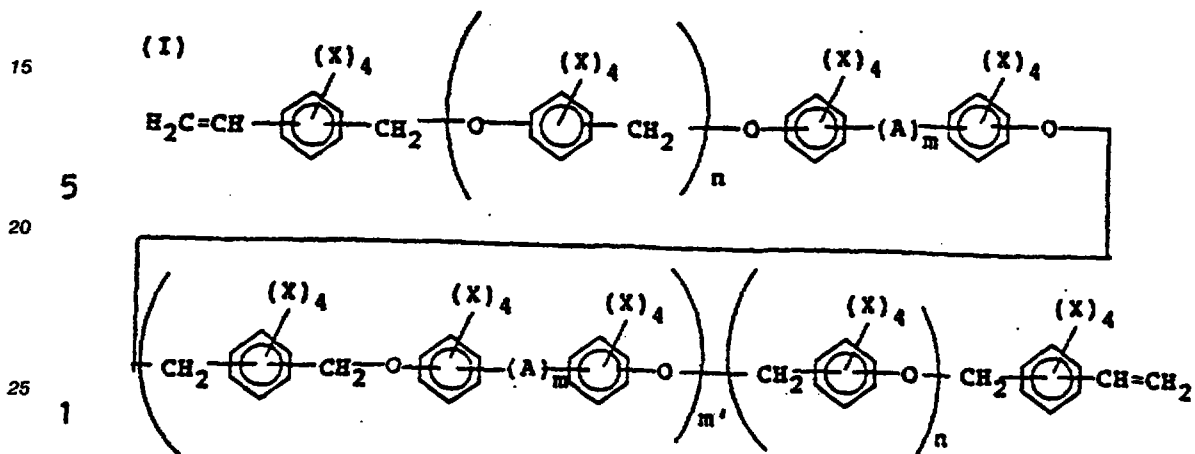


wherein A is a hydrocarbyl group having from 1 to 25 carbon atoms,



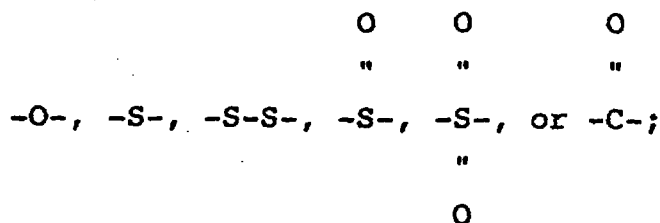
R is hydrogen or a hydrocarbyl group having from 1 to 12 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 12 carbon atoms or a halogen atom; m' has a value of from zero to 200; each m and n independently has a value of zero or one; with the proviso that when m' and n have a value of zero, then A is a dicyclopentadienylene group or a dicyclopentadienylene oligomer group which comprises reacting at least one alkali metal phenoxide of a material containing a plurality of aromatic hydroxyl groups with a vinylbenzyl halide in the presence of a polar aprotic solvent and subsequently recovering therefrom a material wherein more than 95% of the aromatic hydroxyl groups have been converted to vinylbenzyl ether groups.

2. A method for the preparation of a monomer or oligomer containing a plurality of vinylaryl ether groups represented by the following formulas I, II or III



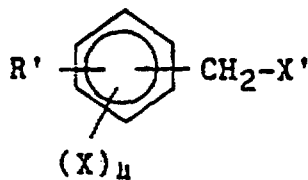
wherein A is a hydrocarbyl group having from 1 to 25 carbon atoms,





- 10 R is hydrogen or a hydrocarbyl group having from 1 to 12 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 12 carbon atoms or a halogen atom; m' has a value of from zero to 200; each m and n independently has a value of zero or one; with the proviso that when m' and n have a value of zero, then A is a dicyclopentadienyl group or a dicyclopentadienyl oligomer group which comprises (A) reacting at least one alkali metal phenoxide of
 15 a material containing a plurality of aromatic hydroxyl groups with at least one chain extender material represented by the following formula IV

(IV)

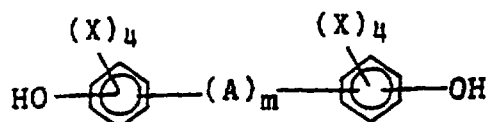


20 wherein R' is a hydroxyl group or a -CH₂X' group; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 12 carbon atoms or a halogen atom; and X' is a halogen; in the presence of a polar aprotic solvent and then (B) reacting the alkali metal phenoxide of the resultant
 25 product with a vinylbenzyl halide in the presence of a polar aprotic solvent and subsequently recovering therefrom a material wherein more than 95% of the aromatic hydroxyl groups have been converted to vinylbenzyl ether groups.

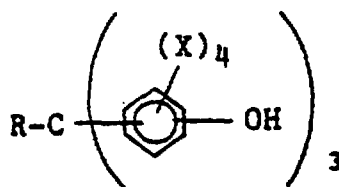
- 30 3. A method as claimed in Claim 1 or 2 wherein A is a hydrocarbyl group having from 1 to 15 carbon atoms; R is hydrogen or a hydrocarbyl group having from 1 to 6 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 6 carbon atoms or a halogen atom; each m and n independently has a value of zero or 1; and m' has a value of from zero to 50.
- 35 4. A method as claimed in Claim 1 or 2, wherein A is a hydrocarbyl group having from 1 to 10 carbon atoms; R is hydrogen or a hydrocarbyl group having from 1 to 4 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 4 carbon atoms or a halogen atom; and m' has a value of from zero to 20.
- 40 5. A method as claimed in Claim 1 or 2 wherein the monomer or oligomer is selected from the group consisting of the bis(vinylbenzyl) ether of dicyclopentadienyl bis(2,6-dimethyl phenol), bis(vinylbenzyl) ether of dicyclopentadienyl bis(o-cresol).
- 45 6. A method as claimed in Claim 1 or Claim 2 wherein
 50 (a) said material containing a plurality of aromatic hydroxyl groups is a material represented by the following formulas V, VI or VII



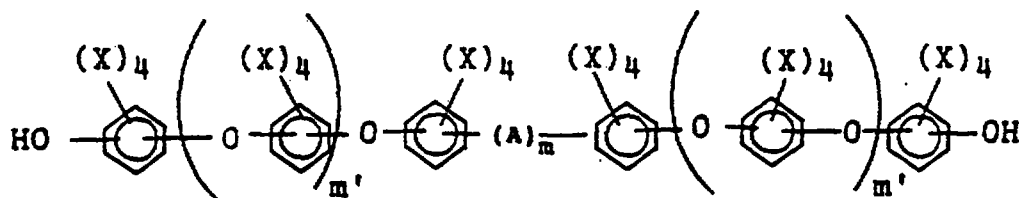
(V)



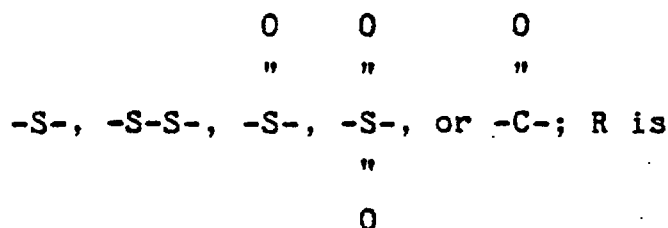
(VI)



(VII)



wherein A is a hydrocarbyl group having from 1 to 25 carbon atoms; -O-,



hydrogen or a hydrocarbyl group having from 1 to 12 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 12 carbon atoms or a halogen atom; each m independently has a value of zero or 1; and m' has a value of from zero to 200;

(b) said extender material is 4-bromomethyl-3,5-dibromo-2,6-dimethyl phenol, 2,4-bis(chloromethyl) mesitylene, 1,2-bis(bromomethyl)benzene, 1,3-bis(bromomethyl)benzene, 1,4-bis(bromo-methyl)-benzene, 1,2-bis(chloromethyl)benzene, 1,3-bis(chloromethyl)benzene, 1,4-bis(chloromethyl)-benzene, 4,6-bis-(chloromethyl)-m-xylene, 2,5-bis(chloromethyl)-p-xylene, and combinations thereof;

(c) said vinylbenzyl halide is vinylbenzyl chloride or vinylbenzyl bromide; and

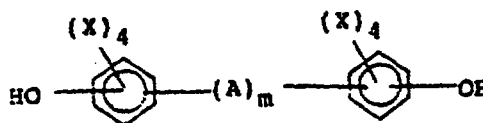
(d) said polar aprotic solvent is dimethyl-formamide, dimethyl acetamide; dimethylsulfoxide; N-methyl pyrrolidinone, dioxane, acetonitrile, tetrahydrofuran, ethylene glycol dimethyl ether, 1,2-dimethoxy propane, tetramethylene sulfone, hexamethyl phosphoramide, methyl ethyl ketone, methyl isobutyl ketone, acetone or mixtures thereof.

7. A method as claimed in Claim 1 or 2 wherein

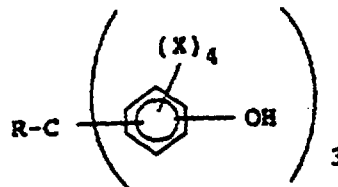
(a) said material containing a plurality of aromatic hydroxyl groups is a material represented by the following formulas V, VI or VII



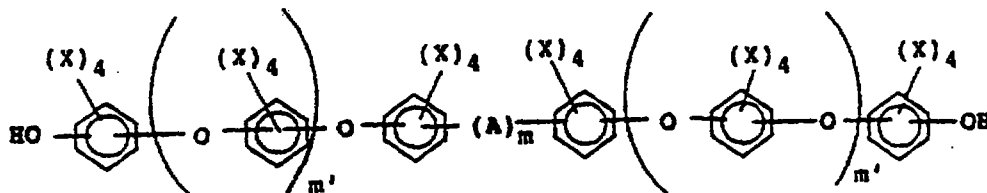
(V)



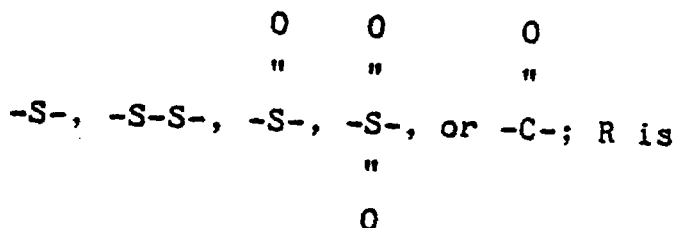
(VI)



(VII)



wherein A is a hydrocarbyl group having from 1 to 15 carbon atoms, -O-,



hydrogen or a hydrocarbyl group having from 1 to 6 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 6 carbon atoms or a halogen atom; preferably bromine; each m independently has a value of zero or 1; and m' has a value of from zero to 50;

(b) said extender material is 4-bromomethyl-3,5-dibromo-2,6-dimethyl phenol, 1,2-bis(bromomethyl)-benzene, 1,3-bis(bromomethyl)-benzene, 1,4-bis(bromomethyl)benzene, 1,2-bis(chloromethyl)-benzene, 1,3-bis(chloromethyl)benzene, 1,4-bis(chloromethyl)benzene, 2,4-bis(chloromethyl)-mesitylene, 4,6-bis(chloromethyl)-m-xylene, 2,5-bis(chloromethyl)-p-xylene, and combinations thereof;

(c) said vinylbenzyl halide is vinylbenzyl chloride or vinylbenzyl bromide; and

(d) said polar aprotic solvent is dimethylformamide, dimethyl acetamide; dimethylsulfoxide; N-methyl pyrrolidinone, dioxane, acetonitrile, tetrahydrofuran, ethylene glycol dimethyl ether, 1,2-dimethoxy propane, tetramethylene sulfone, hexamethyl phosphoramide, methyl ethyl ketone, methyl isobutyl ketone, acetone or mixtures thereof.

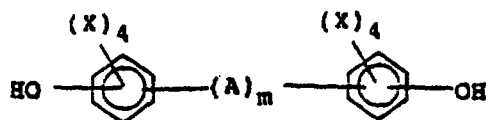
8. A method as claimed in Claim 1 or Claim 2 wherein



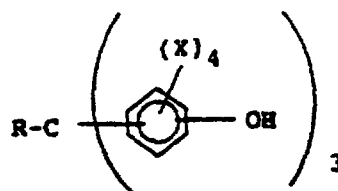


(a) said material containing a plurality of aromatic hydroxyl groups is a material represented by the following formulas V, VI or VII

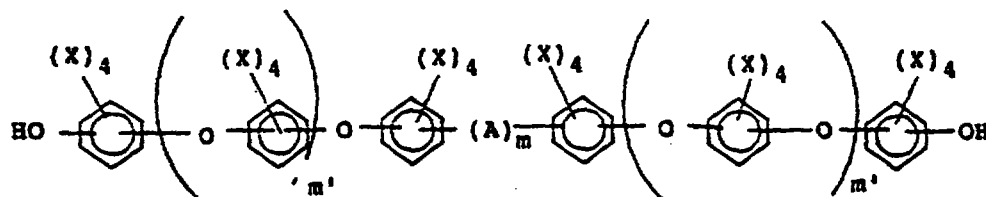
(V)



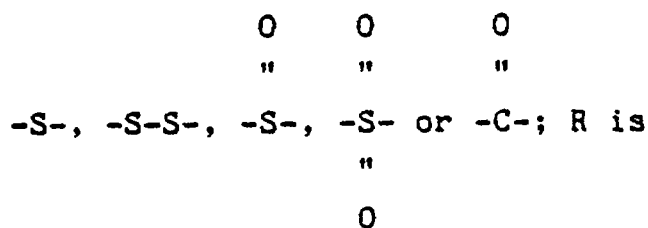
(VI)



(VII)



wherein A is a hydrocarbyl group having from 1 to 10 carbon atoms, -O-,



hydrogen or a hydrocarbyl group having from 1 to 4 carbon atoms; each X is independently hydrogen, a hydrocarbyl or hydrocarbyloxy group having from 1 to 4 carbon atoms or a halogen atom; preferably bromine; each m independently has a value of zero or 1; and m' has a value of from zero to 20;

(b) said extender material is 4-bromomethyl-3,5-dibromo-2,6-dimethyl phenol, 1,2-bis(bromomethyl)-benzene, 1,3-bis(bromomethyl)-benzene, 1,4-bis(bromomethyl)benzene, 1,2-bis-(chloromethyl)-benzene, 1,3-bis-(chloromethyl)benzene, 1,4-bis(chloromethyl)benzene, 2,4-bis-(chloromethyl)-mesitylene, 4,6-bis-(chloromethyl)-m-xylene, 2,5-bis(chloromethyl)-p-xylene, and combinations thereof;

(c) said vinylbenzyl halide is vinylbenzyl chloride or vinylbenzyl bromide; and

(d) said polar aprotic solvent is dimethyl-formamide, dimethyl acetamide, dimethylsulfoxide, N-



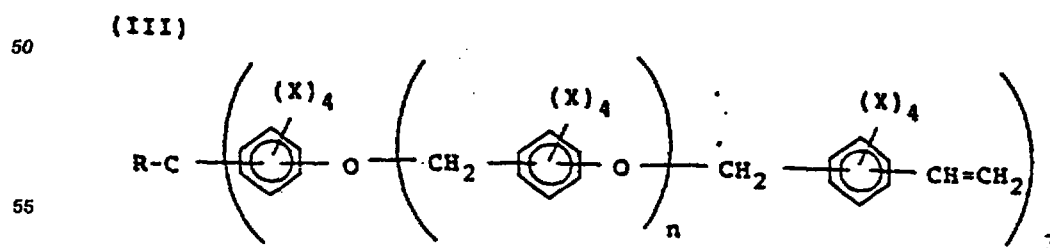
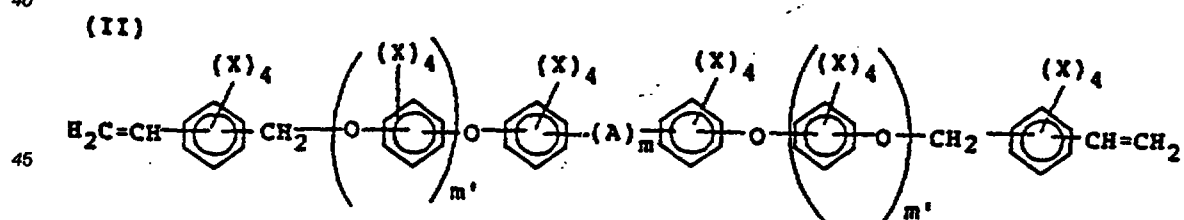
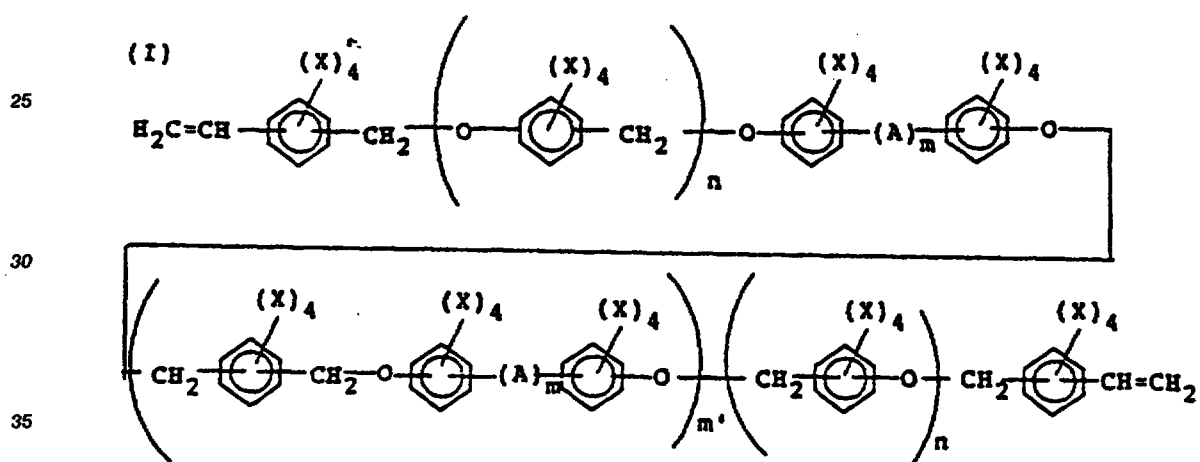
methyl pyrrolidinone, dioxane, acetonitrile, tetrahydrofuran, ethylene glycol dimethyl ether, 1,2-dimethoxy propane, tetramethylene sulfone, hexamethyl phosphoramide, methyl ethyl ketone, methyl isobutyl ketone, acetone or mixtures thereof.

9. A method as claimed in any of Claims 1 to 8 wherein the reaction is conducted at (1) a temperature of from -30°C to 100°C for 0.5 to 20 hours, (2) a temperature of from 0°C to 80°C for 0.5 to 15 hours, or (3) a temperature of from 15°C to 60°C for 0.5 to 6 hours.
10. Use of a monomer or an oligomer produced according to any one of Claims 1 to 4 for making a curable composition.
11. Use of a monomer or an oligomer according to Claim 10 together with a curable resin selected from the group consisting of bismaleicimide, polycyanates of polyphenols, polypropargyl ethers of polyphenols, epoxides and mixtures thereof.

Revendications

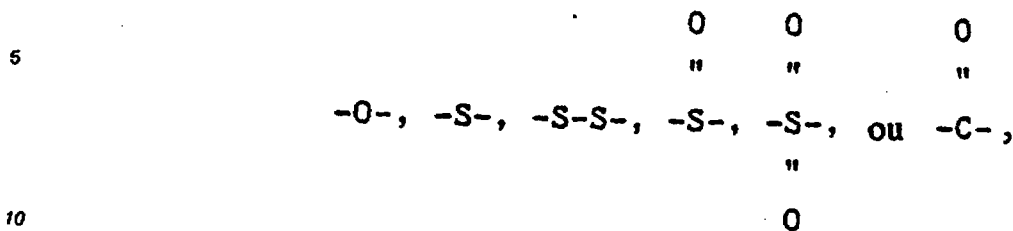
Revendications pour les Etats contractants suivants : BE, CH, LI, DE, FR, GB, IT, NL, SE

1. Monomère ou oligomère contenant plusieurs groupes vinylaryloxy, représenté par l'une des formules I, II et III suivantes :





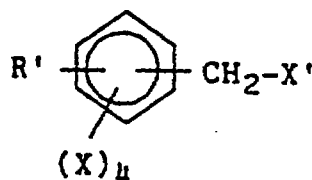
dans lesquelles A est un groupe hydrocarbyle ayant de 1 à 25 atomes de carbone,



R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 12 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 12 atomes de carbone, ou un atome d'halogène, m' a une valeur comprise dans l'intervalle allant de zéro à 200, chaque m et n a indépendamment une valeur de zéro ou de un, étant entendu que, lorsque m' et n valent zéro, A est un groupe dicyclopentadiényle ou un groupe oligomère de dicyclopentadiényle.

2. Monomère ou oligomère selon la revendication 1, dans lequel A est un groupe hydrocarbyle ayant de 1 à 15 atomes de carbone, R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 6 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 6 atomes de carbone ou un atome d'halogène, chaque m et n a indépendamment une valeur de zéro ou de 1, et m' a une valeur de zéro à 50.
3. Monomère ou oligomère selon la revendication 1, dans lequel A est un groupe hydrocarbyle ayant de 1 à 10 atomes de carbone, R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 4 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 4 atomes de carbone, ou un atome d'halogène, et m' a une valeur de zéro à 20.
4. Monomère ou oligomère selon la revendication 1, qui est choisi dans le groupe constitué par le bis(vinylbenzyl)éther de dicyclopentadiényl-bis(2,6-diméthylphénol), le bis(vinylbenzyl)éther de dicyclopentadiényl-bis(o-crésol).
5. Procédé de préparation d'un monomère ou d'un oligomère selon l'une quelconque des revendications 1 à 4, qui comprend la réaction d'au moins un phénate de métal alcalin d'une substance contenant plusieurs groupes hydroxyle aromatiques avec un halogénure de vinylbenzyle, en présence d'un solvant aprotique polaire, et la récupération ultérieure à partir de là d'une substance dans laquelle plus de 95 % des groupes hydroxyle aromatiques ont été transformés en groupes vinylbenzyloxy.
6. Procédé de préparation d'un monomère ou d'un oligomère selon l'une quelconque des revendications 1 à 4, qui comprend (A) la réaction d'au moins un phénate de métal alcalin d'une substance contenant plusieurs groupes hydroxyle aromatiques avec au moins un composé prolongateur de chaîne représenté par la formule IV suivante

(IV)



dans laquelle R' est un groupe hydroxyle ou un groupe $-\text{CH}_2\text{X}'$, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 12 atomes de carbone ou un atome d'halogène, et X' est un atome d'halogène, en présence d'un solvant aprotique polaire, et ensuite (B) la réaction du phénate de métal alcalin du produit résultant avec un halogénure de

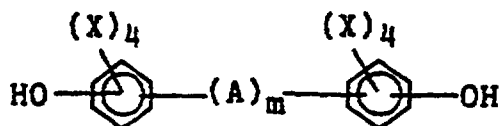


vinylbenzyle, en présence d'un solvant aprotique polaire, et ensuite la récupération à partir de là d'une substance dans laquelle plus de 95 % des groupes hydroxyle aromatiques ont été convertis en groupes vinylbenzyloxy.

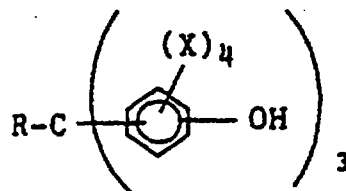
5 7. Procédé selon la revendication 5 ou 6, dans lequel :

(a) ladite substance contenant plusieurs groupes hydroxyle aromatiques est une substance représentée par l'une des formules V, VI et VII suivantes :

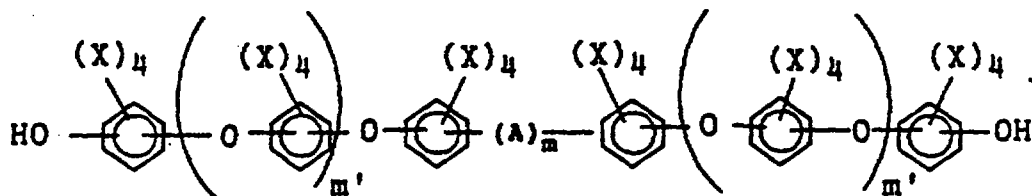
(V)



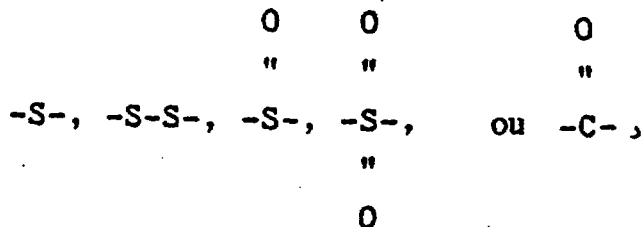
(VI)



(VII)



dans lesquelles A est un groupe hydrocarbyle ayant de 1 à 25 atomes de carbone, -O-,



R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 12 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 12 atomes de carbone ou un atome d'halogène, chaque m a indépendamment une valeur de zéro ou de 1, et m' a une valeur de zéro à 200,

(b) ledit composé prolongateur est le 4-bromométhyl-3,5-dibromo-2,6-diméthylphénol, le 2,4-bis(chlorométhyl)mésitylène, le 1,2-bis(bromométhyl)benzène, le 1,3-bis(bromométhyl)benzène, le 1,4-bis(bromométhyl)benzène, le 1,2-bis(chlorométhyl)benzène, le 1,3-bis(chlorométhyl)benzène, le 1,4-bis(chlorométhyl)benzène, le 4,6-bis(chlorométhyl)-m-xylène, le 2,5-bis(chlorométhyl)-p-xylène, ou



une de leurs combinaisons,

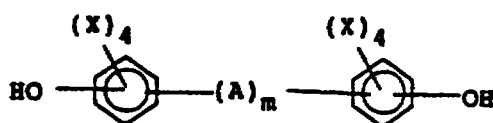
(c) ledit halogénure de vinylbenzyle est le chlorure de vinylbenzyle ou le bromure de vinylbenzyle, et

(d) ledit solvant aprotique polaire est le diméthylformamide, le diméthylacétamide, le diméthylsulfoxyde, la N-méthylpyrrolidinone, le dioxane, l'acétonitrile, le tétrahydrofurane, l'éther diméthylique de l'éthylèneglycol, le 1,2-diméthoxypropane, la tétraméthylènesulfone, l'hexaméthylphosphoramide, la méthyléthylcétone, la méthylisobutylcétone, l'acétone ou un de leurs mélanges.

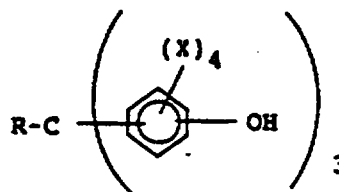
8. Procédé selon la revendication 5 ou 6, dans lequel :

(a) ladite substance contenant plusieurs groupes hydroxyle aromatiques est une substance représentée par l'une des formules V, VI et VII suivantes

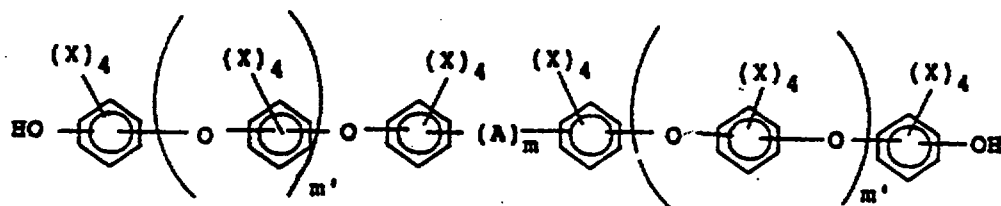
(V)



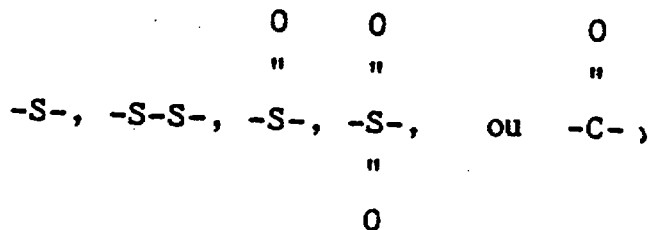
(VI)



(VII)



dans lesquelles A est un groupe hydrocarbyle ayant de 1 à 15 atomes de carbone, -O-,



R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 6 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 6 atomes de carbone ou un atome d'halogène, de préférence le brome, chaque m a



indépendamment une valeur de zéro ou de 1, et m' a une valeur de zéro à 50,

(b) ledit composé prolongateur est le 4-bromométhyl-3,5-dibromo-2,6-diméthylphénol, le 2,4-bis-(chlorométhyl)mésitylène, le 1,2-bis(bromométhyl)benzène, le 1,3-bis(bromométhyl)benzène, le 1,4-bis(bromométhyl)benzène, le 1,2-bis-(chlorométhyl)benzène, le 1,3-bis(chlorométhyl)benzène, le 1,4-bis(chlorométhyl)benzène, le 4,6-bis(chlorométhyl)-m-xylène, le 2,5-bis(chlorométhyl)-p-xylène, ou une de leurs combinaisons,

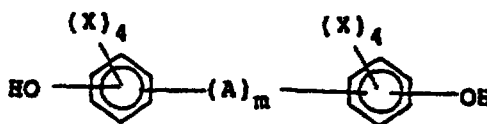
(c) ledit halogénure de vinylbenzyle est le chlorure de vinylbenzyle ou le bromure de vinylbenzyle, et

(d) ledit solvant aprotique polaire est le diméthylformamide, le diméthylacétamide, le diméthylsulfoxyde, la N-méthylpyrrolidinone, le dioxane, l'acétonitrile, le tétrahydrofurane, l'éther diméthylique de l'éthylèneglycol, le 1,2-diméthoxypropane, la tétraméthylènesulfone, l'hexaméthylphosphoramide, la méthyléthylcétone, la méthylisobutylcétone, l'acétone ou un de leurs mélanges. méthyléthylcétone, la méthylisobutylcétone, l'acétone ou un de leurs mélanges.

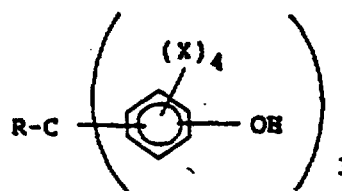
9. Procédé selon la revendication 5 ou 6, dans lequel :

(a) ladite substance contenant plusieurs groupes hydroxyle aromatiques est une substance représentée par l'une des formules V, VI et VII suivantes :

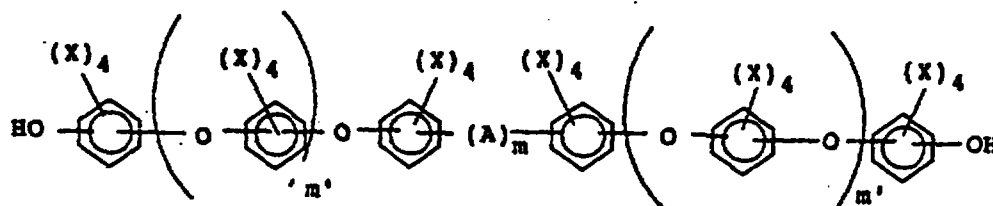
(V)



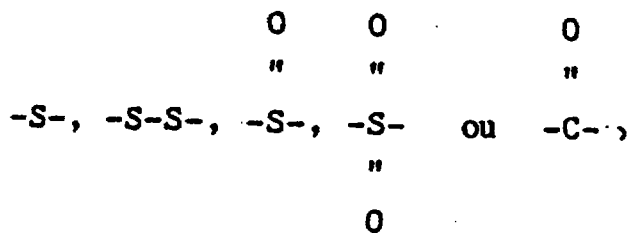
(VI)



(VII)



dans lesquelles A est un groupe hydrocarbyle ayant de 1 à 10 atomes de carbone, -O-,



10 R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 4 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 4 atomes de carbone ou un atome d'halogène, de préférence de brome, chaque m a indépendamment une valeur de zéro ou de 1, et m' a une valeur de zéro à 20,

15 (b) ledit composé prolongateur est le 4-bromométhyl-3,5-dibromo-2,6-diméthylphénol, le 1,2-bis(bromométhyl)benzène, le 1,3-bis(bromométhyl)benzène, le 1,4-bis(bromométhyl)benzène, le 1,2-bis(chlorométhyl)benzène, le 1,3-bis(chlorométhyl)benzène, le 1,4-bis(chlorométhyl)benzène, le 2,4-bis(chlorométhyl)mésitylène, le 4,6-bis(chlorométhyl)-m-xylène, le 2,5-bis(chlorométhyl)-p-xylène, ou une de leurs combinaisons,

20 (c) ledit halogénure de vinylbenzyle est le chlorure de vinylbenzyle ou le bromure de vinylbenzyle, et

(d) ledit solvant aprotique polaire est le diméthylformamide, le diméthylacétamide, le diméthylsulfoxyde, la N-méthylpyrrolidinone, le dioxane, l'acétonitrile, le tétrahydrofurane, l'éther diméthylique de l'éthylèneglycol, le 1,2-diméthoxypropane, la tétraméthylènesulfone, l'hexaméthylphosphoramide, la méthyléthylcétone, la méthylisobutylcétone, l'acétone ou un de leurs mélanges. sulfone, l'hexaméthylphosphoramide, la méthyléthylcétone, la méthylisobutylcétone, l'acétone ou un de leurs mélanges.

30 10. Procédé selon l'une quelconque des revendications 5 à 9, dans lequel la réaction est conduite à (1) une température de -30°C à 100°C pendant 0,5 à 20 heures, (2) une température de 0°C à 80°C pendant 0,5 à 15 heures, ou (3) une température de 15°C à 60°C pendant 0,5 à 6 heures.

11. Composition durcissable comprenant un monomère ou un oligomère selon l'une quelconque des revendications 1 à 3.

35 12. Composition durcissable selon la revendication 11, comprenant en outre une résine durcissable choisie dans le groupe constitué par le bismaléimide, les polycyanates de polyphénols, les éthers polypropargyliques de polyphénols, les époxydes et leurs mélanges.

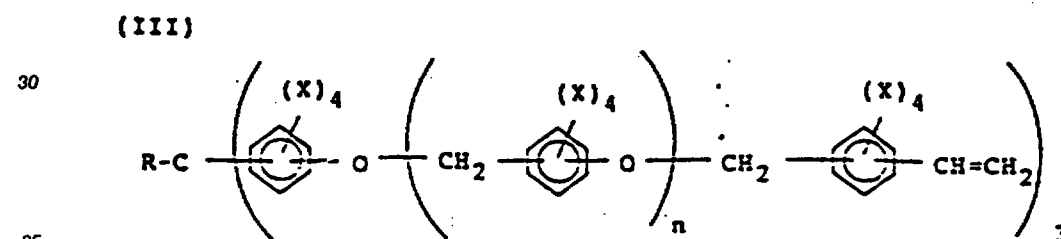
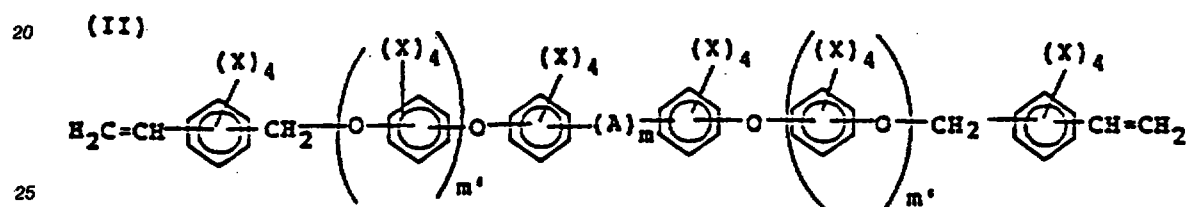
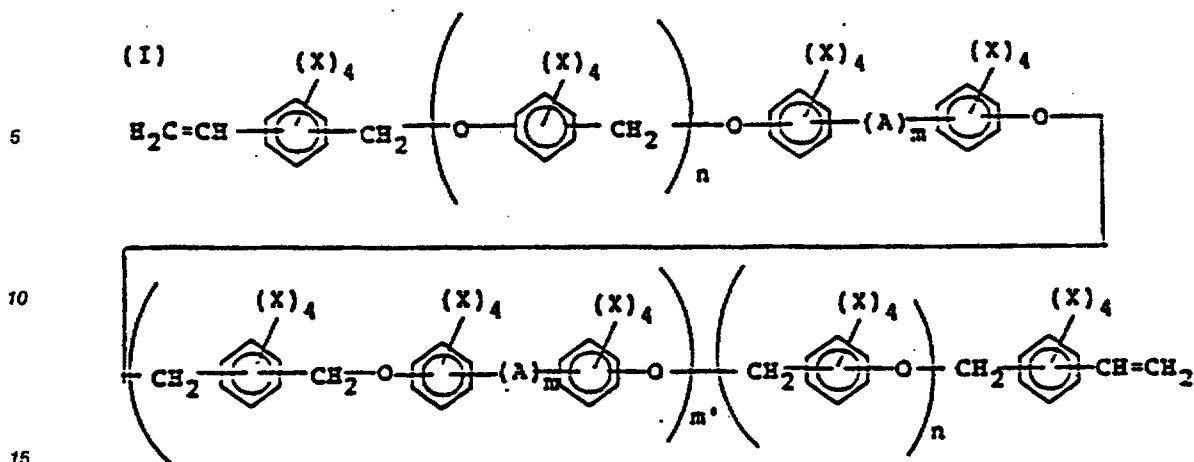
Revendications pour les Etats contractants suivants : AT, ES

40 1. Procédé de préparation d'un monomère ou oligomère contenant plusieurs groupes vinylaryloxy, représenté par l'une des formules I, II et III suivantes :

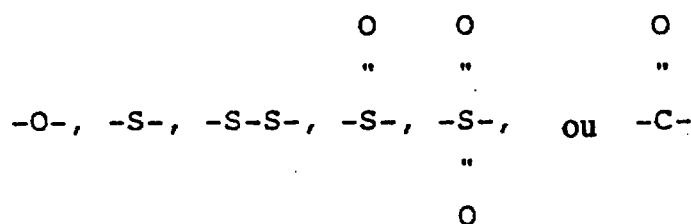
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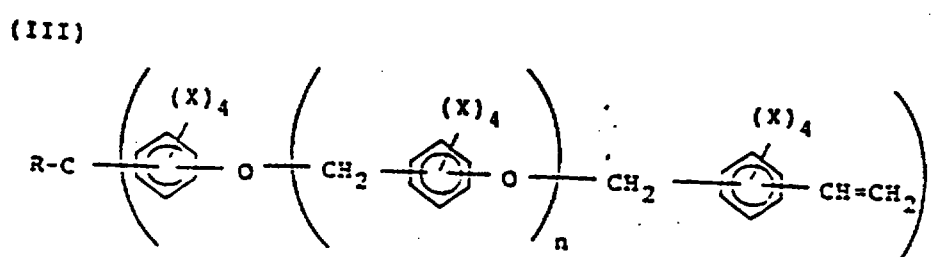
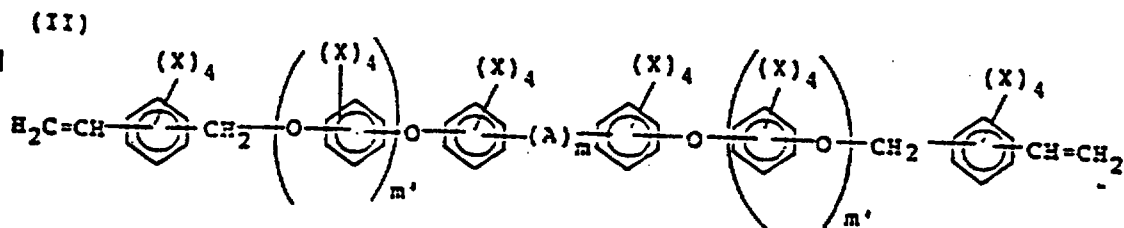
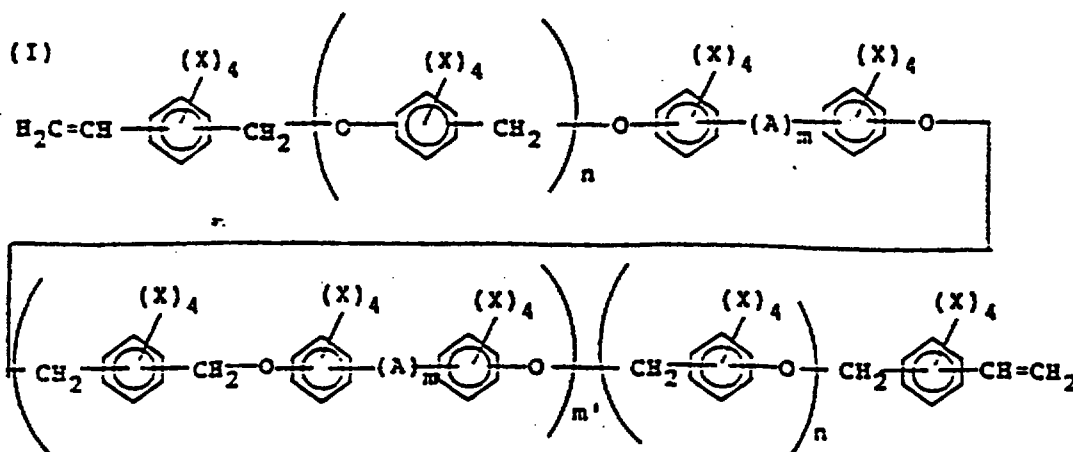
dans lesquelles A est un groupe hydrocarbyle ayant de 1 à 25 atomes de carbone,



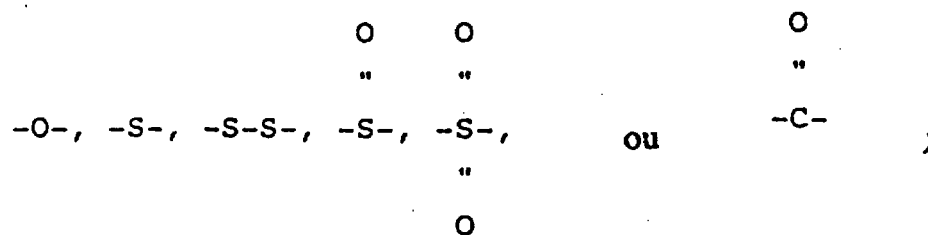
R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 12 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 12 atomes de carbone, ou un atome d'halogène, m' a une valeur comprise dans l'intervalle allant de zéro à 200, chaque m et n a indépendamment une valeur de zéro ou de un, étant entendu que, lorsque m' et n valent zéro, A est un groupe dicyclopentadiényle ou un groupe oligomère de dicyclopentadiényle, qui comprend la réaction d'au moins un phénate de métal alcalin d'une substance contenant plusieurs groupes hydroxyle aromatiques avec un halogénure de vinylbenzyle, en présence d'un solvant aprotique polaire, et la récupération ultérieure à partir de là d'une substance dans laquelle plus de 95 % des groupes hydroxyle aromatiques ont été transformés en groupes vinylbenzyloxy.



2. Procédé de préparation d'un monomère ou oligomère contenant plusieurs groupes vinylaryloxy, représenté par l'une des formules I, II et III suivantes :

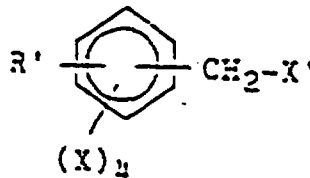


dans lesquelles A est un groupe hydrocarbyle ayant de 1 à 25 atomes de carbone,



R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 12 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 12 atomes de carbone, ou un atome d'halogène, m' a une valeur comprise dans l'intervalle allant de zéro à 200, chaque m et n a indépendamment une valeur de zéro ou de un, étant entendu que, lorsque m' et n valent zéro, A est un groupe dicyclopentadiényle ou un groupe oligomère de dicyclopentadiényle, qui comprend (A) la réaction d'au moins un phénate de métal alcalin d'une substance contenant plusieurs groupes hydroxyle aromatiques avec au moins un composé prolongateur de chaîne représenté par la formule IV suivante

(IV)



dans laquelle R' est un groupe hydroxyle ou un groupe $-CH_2X'$, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 12 atomes de carbone ou un atome d'halogène, et X' est un atome d'halogène, en présence d'un solvant aprotique polaire, et ensuite (B) la réaction du phénate de métal alcalin du produit résultant avec un halogénure de vinylbenzyle, en présence d'un solvant aprotique polaire, et ensuite la récupération à partir de là d'une substance dans laquelle plus de 95 % des groupes hydroxyle aromatiques ont été convertis en groupes vinylbenzyloxy.

3. Procédé selon la revendication 1 ou 2, dans lequel A est un groupe hydrocarbyle ayant de 1 à 15 atomes de carbone, R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 6 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 6 atomes de carbone ou un atome d'halogène, chaque m et n a indépendamment une valeur de zéro ou de 1, et m' a une valeur de zéro à 50.

4. Procédé selon la revendication 1 ou 2, dans lequel A est un groupe hydrocarbyle ayant de 1 à 10 atomes de carbone, R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 4 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 4 atomes de carbone, ou un atome d'halogène, et m' a une valeur de zéro à 20.

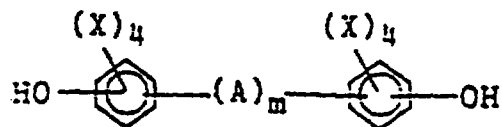
5. Procédé selon la revendication 1 ou 2, dans lequel le monomère ou l'oligomère est choisi dans le groupe constitué par le bis(vinylbenzyl)éther de dicyclopentadiényl-bis(2,6-diméthylphénol), le bis(vinylbenzyl)éther de dicyclopentadiényl-bis(o-crésol).

6. Procédé selon la revendication 1 ou 2, dans lequel

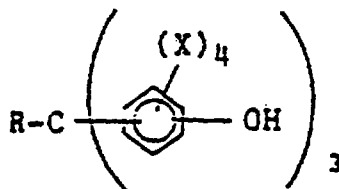
(a) ladite substance contenant plusieurs groupes hydroxyle aromatiques est une substance représentée par l'une des formules V, VI et VII suivantes :



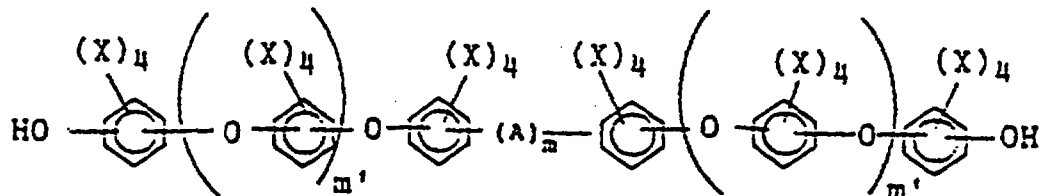
(V)



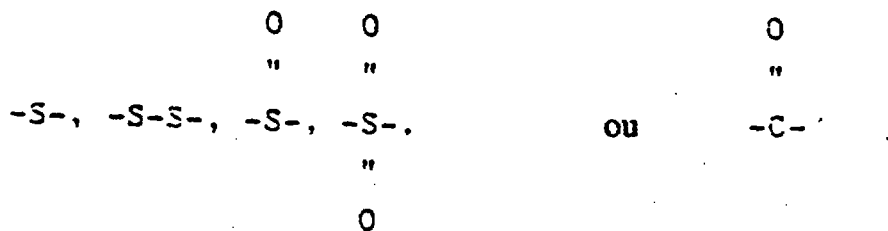
(VI)



(VII)



dans lesquelles A est un groupe hydrocarbyle ayant de 1 à 25 atomes de carbone, -O-,



R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 12 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 12 atomes de carbone ou un atome d'halogène, chaque m a indépendamment une valeur de zéro ou de 1, et m' a une valeur de zéro à 200,

(b) ledit composé prolongateur est le 4-bromométhyl-3,5-dibromo-2,6-diméthylphénol, le 2,4-bis(chlorométhyl)mésitylène, le 1,2-bis(bromométhyl)benzène, le 1,3-bis(bromométhyl)benzène, le 1,4-bis(bromométhyl)benzène, le 1,2-bis(chlorométhyl)benzène, le 1,3-bis(chlorométhyl)benzène, le 1,4-bis(chlorométhyl)benzène, le 4,6-bis(chlorométhyl)-m-xylène, le 2,5-bis(chlorométhyl)-p-xylène, ou une de leurs combinaisons,

(c) ledit halogénure de vinylbenzyle est le chlorure de vinylbenzyle ou le bromure de vinylbenzyle, et

(d) ledit solvant aprotique polaire est le diméthylformamide, le diméthylacétamide, le diméthylsulfoxyde, la N-méthylpyrrolidinone, le dioxane, l'acétonitrile, le tétrahydrofurane, l'éther diméthyllique de l'éthylèneglycol, le 1,2-diméthoxypropane, la tétraméthylènesulfone, l'hexaméthylphosphoramide,

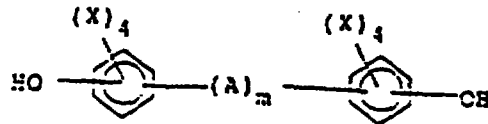


la méthyléthylcétone, la méthylisobutylcétone, l'acétone ou un de leurs mélanges.

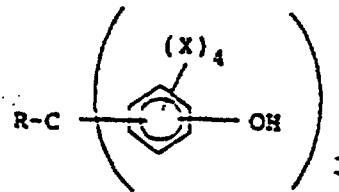
7. Procédé selon la revendication 1 ou 2, dans lequel

- (a) ladite substance contenant plusieurs groupes hydroxyle aromatiques est une substance représentée par l'une des formules V, VI et VII suivantes

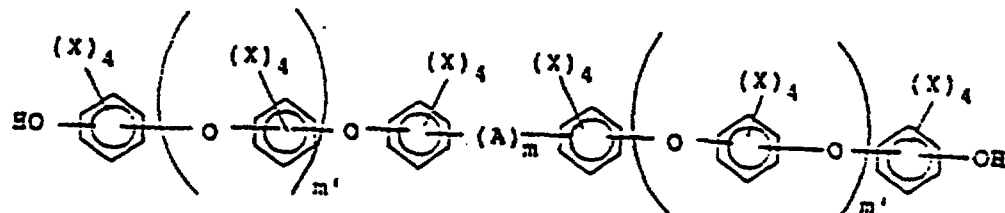
(V)



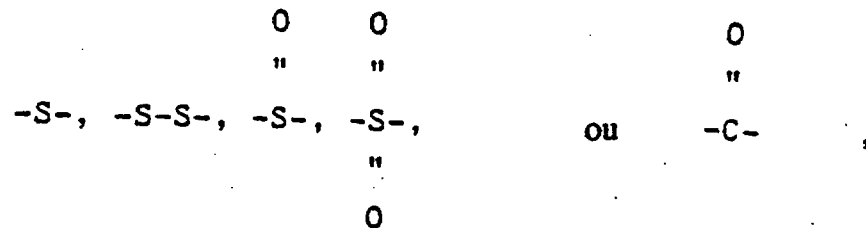
(VI)



(VII)



dans lesquelles A est un groupe hydrocarbyle ayant de 1 à 15 atomes de carbone, -O-,



R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 6 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 6 atomes de carbone ou un atome d'halogène, de préférence le brome, chaque m a indépendamment une valeur de zéro ou de 1, et m' a une valeur de zéro à 50,

(b) ledit composé prolongateur est le 4-bromométhyl-3,5-dibromo-2,6-diméthylphénol, le 1,2-bis-(bromométhyl)benzène, le 1,3-bis(bromométhyl)benzène, le 1,4-bis(bromométhyl)benzène, le 1,2-bis-(chlorométhyl)benzène, le 1,3-bis(chlorométhyl)benzène, le 1,4-bis(chlorométhyl)benzène, le 2,4-bis(chloro-méthyl)mésitylène, le 4,6-bis(chlorométhyl)-m-xylène, le 2,5-bis(chlorométhyl)-p-xylène, ou une de leurs combinaisons,



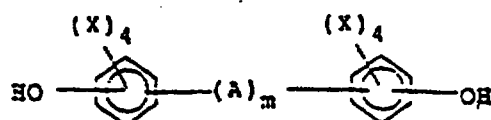
(c) ledit halogénure de vinylbenzyle est le chlorure de vinylbenzyle ou le bromure de vinylbenzyle, et

(d) ledit solvant aprotique polaire est le diméthylformamide, le diméthylacétamide, le diméthylsulfoxyde, la N-méthylpyrrolidinone, le dioxane, l'acétonitrile, le tétrahydrofurane, l'éther diméthylique de l'éthylèneglycol, le 1,2-diméthoxypropane, la tétraméthylènesulfone, l'hexaméthylphosphoramide, la méthyléthylcétone, la méthylisobutylcétone, l'acétone ou un de leurs mélanges.

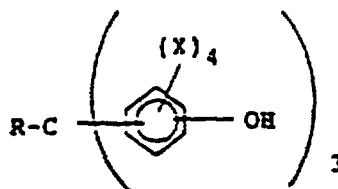
8. Procédé selon la revendication 1 ou 2, dans lequel

(a) ladite substance contenant plusieurs groupes hydroxyle aromatiques est une substance représentée par l'une des formules V, VI et VII suivantes :

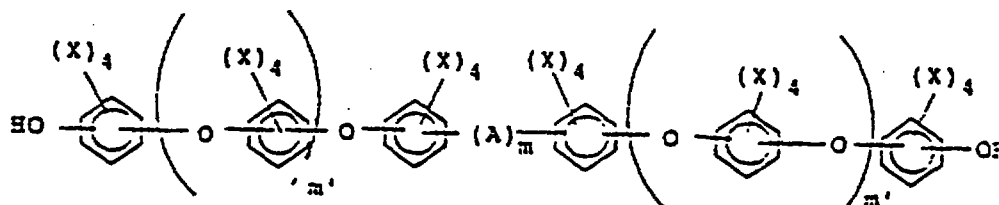
(V)



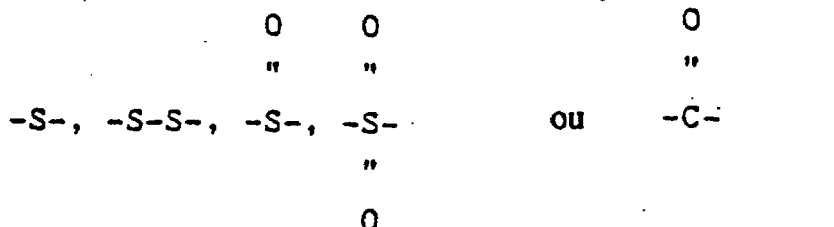
(VI)



(VII)



dans lesquelles A est un groupe hydrocarbyle ayant de 1 à 10 atomes de carbone, -O-,



R est un atome d'hydrogène ou un groupe hydrocarbyle ayant de 1 à 4 atomes de carbone, chaque X représente indépendamment un atome d'hydrogène, un groupe hydrocarbyle ou hydrocarbyloxy ayant de 1 à 4 atomes de carbone ou un atome d'halogène, de préférence de brome, chaque m a indépendamment une valeur de zéro ou de 1, et m' a une valeur de zéro à 20,



(b) ledit composé prolongateur est le 4-bromométhyl-3,5-dibromo-2,6-diméthylphénol, le 1,2-bis-(bromométhyl)benzène, le 1,3-bis(bromométhyl)benzène, le 1,4-bis(bromométhyl)benzène, le 1,2-bis(chlorométhyl)benzène, le 1,3-bis(chlorométhyl)benzène, le 1,4-bis(chlorométhyl)benzène, le 2,4-bis(chlorométhyl)mésitylène, le 4,6-bis(chlorométhyl)-m-xylène, le 2,5-bis(chlorométhyl)-p-xylène, ou une de leurs combinaisons,

(c) ledit halogénure de vinylbenzyle est le chlorure de vinylbenzyle ou le bromure de vinylbenzyle, et

(d) ledit solvant aprotique polaire est le diméthylformamide, le diméthylacétamide, le diméthylsulfoxyde, la N-méthylpyrrolidinone, le dioxane, l'acétonitrile, le tétrahydrofurane, l'éther diméthylique de l'éthylèneglycol, le 1,2-diméthoxypropane, la tétraméthylènesulfone, l'hexaméthylphosphoramide, la méthyléthylcétone, la méthylisobutylcétone, l'acétone ou un de leurs mélanges.

9. Procédé selon l'une quelconque des revendications 1 à 8, dans lequel la réaction est conduite à (1) une température de -30°C à 100°C pendant 0,5 à 20 heures, (2) une température de 0°C à 80°C pendant 0,5 à 15 heures, ou (3) une température de 15°C à 60°C pendant 0,5 à 6 heures.

10. Utilisation d'un monomère ou oligomère préparé selon l'une quelconque des revendications 1 à 4, pour préparer une composition durcissable.

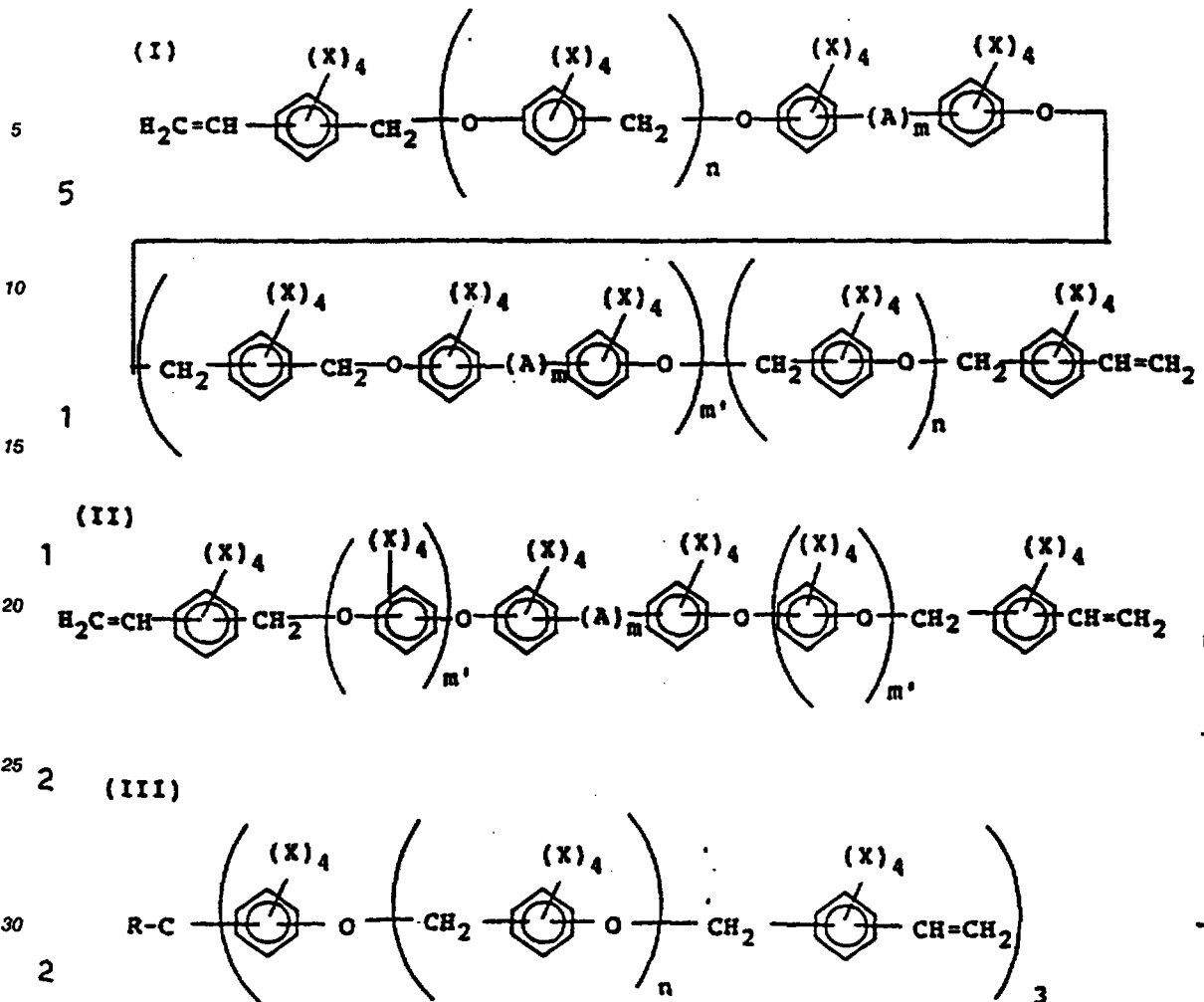
11. Utilisation d'un monomère ou d'un oligomère selon la revendication 10, conjointement avec une résine durcissable choisie dans le groupe constitué par le bismaléimide, les polycyanates de polyphénols, les éthers polypropargyliques de polyphénols, les époxydes et leurs mélanges.

Patentansprüche

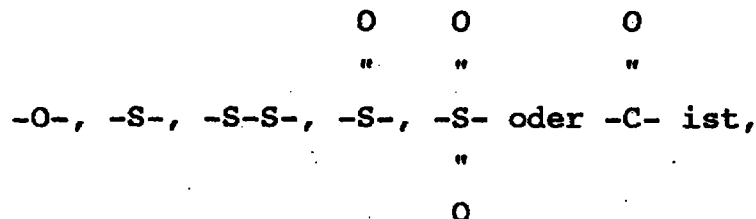
Patentansprüche für folgende Vertragsstaaten : BE, CH, LI, DE, FR, GB, IT, NL, SE

1. Eine Mehrzahl von Vinylarylethergruppen enthaltendes Monomer oder Oligomer, dargestellt durch die folgenden Formeln I, II oder III





worin A eine Kohlenwasserstoffgruppe mit 1 bis 25 Kohlenstoffatomen,



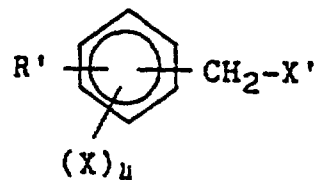
R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen oder ein Halogenatom ist, m' einen Wert von 0 bis 200 besitzt, jedes m und n unabhängig einen Wert von 0 oder 1 besitzt, unter der Voraussetzung, daß A eine Dicyclopentadienylgruppe oder eine Dicyclopentadienyl-Oligomergruppe ist, wenn m' und n einen Wert von 0 besitzen.

2. Monomer oder Oligomer nach Anspruch 1, worin A eine Kohlenwasserstoffgruppe mit 1 bis 15 Kohlenstoffatomen ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 6 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 6 Kohlenstoffatomen oder ein Halogenatom ist, jedes m und n unabhängig einen Wert von 0 oder 1 hat und m' einen Wert von 0 bis 50 hat.



3. Monomer oder Oligomer nach Anspruch 1, worin A eine Kohlenwasserstoffgruppe mit 1 bis 10 Kohlenstoffatomen ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 4 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 4 Kohlenstoffatomen oder ein Halogenatom ist und m' einen Wert von 0 bis 20 hat.
4. Monomer oder Oligomer nach Anspruch 1, worin das Monomer oder Oligomer aus der Gruppe, bestehend aus Bis(vinylbenzyl)ether von Dicyclopentadienyl-bis(2,6-dimethylphenol), Bis(vinylbenzyl)ether von Dicyclopentadienyl-bis(o-cresol) ausgewählt ist.
5. Verfahren zur Herstellung eines Monomers oder Oligomers nach einem der Ansprüche 1 bis 4, umfassend die Umsetzung von mindestens einem Alkalimetallphenoxid eines Materials, das eine Mehrzahl von aromatischen Hydroxylgruppen enthält, mit einem Vinylbenzylhalogenid in Gegenwart eines polaren aprotischen Lösungsmittels und anschließende Gewinnung eines Materials daraus, bei dem mehr als 95 % der aromatischen Hydroxylgruppen in Vinylbenzylethergruppen umgewandelt worden sind.
6. Verfahren zur Herstellung eines Monomers oder Oligomers nach einem der Ansprüche 1 bis 4, umfassend (A) Umsetzen von mindestens einem Alkalimetallphenoxid eines Materials, das eine Mehrzahl von aromatischen Hydroxylgruppen enthält, mit mindestens einem Kettenausdehnungsmaterial, dargestellt durch die folgende Formel IV

(IV)

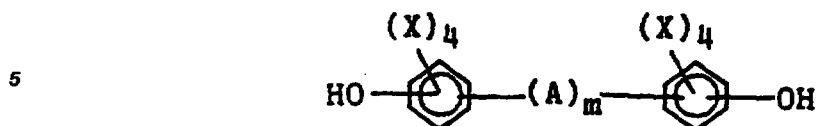


worin R' eine Hydroxylgruppe oder eine -CH₂X'-Gruppe ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen oder ein Halogenatom ist und X' ein Halogen ist, in Gegenwart eines polaren aprotischen Lösungsmittels und dann (B) Umsetzen des Alkalimetallphenoxids des resultierenden Produkts mit einem Vinylbenzylhalogenid in Gegenwart eines polaren aprotischen Lösungsmittels und anschliessende Gewinnung eines Materials daraus, bei dem mehr als 95 % der aromatischen Hydroxylgruppen in Vinylbenzylethergruppen umgewandelt worden sind.

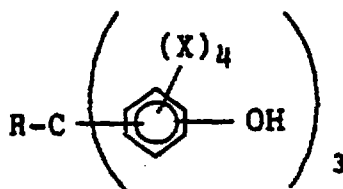
7. Verfahren nach Anspruch 5 oder 6, worin
- (a) das eine Mehrzahl von aromatischen Hydroxylgruppen enthaltende Material ein Material ist, dargestellt durch die folgenden Formeln V, VI oder VII



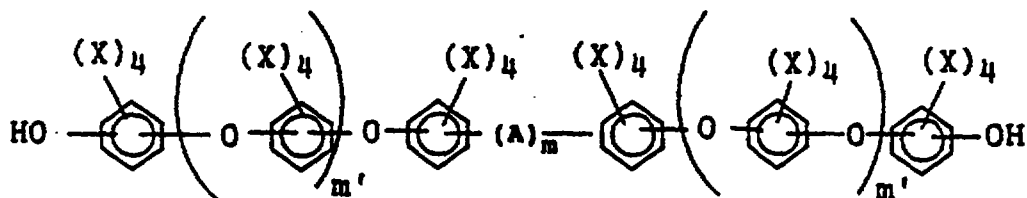
(V)



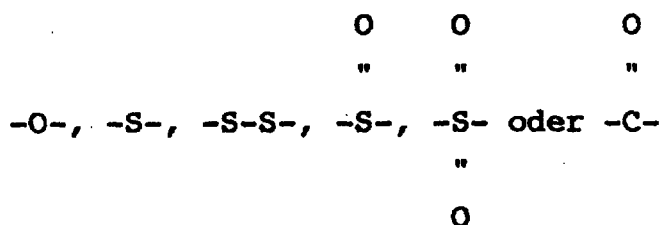
(VI)



(VII)



worin A eine Kohlenwasserstoffgruppe mit 1 bis 25 Kohlenstoffatomen,



ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen oder ein Halogenatom ist, jedes m unabhängig einen Wert von 0 oder 1 besitzt und m' einen Wert von 0 bis 200 besitzt,

(b) das Ausdehnungsmaterial 4-Brommethyl-3,5-dibrom-2,6-dimethylphenol, 2,4-Bis(chlormethyl)-mesitylen, 1,2-Bis(brommethyl)benzol, 1,3-Bis(brommethyl)benzol, 1,4-Bis(brommethyl)benzol, 1,2-Bis(chlormethyl)benzol, 1,3-Bis(chlormethyl)benzol, 1,4-Bis(chlormethyl)benzol, 4,6-Bis(chlormethyl)-m-xylol, 2,5-Bis(chlormethyl)-p-xylol und Kombinationen davon ist,

(c) das Vinylbenzylhalogenid Vinylbenzylchlorid oder Vinylbenzylbromid ist und

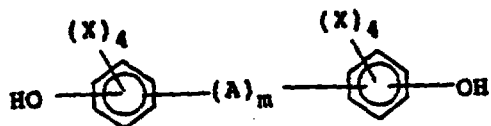
(d) das polare aprotische Lösungsmittel Dimethylformamid, Dimethylacetamid, Dimethylsulfoxid, N-Methylpyrrolidon, Dioxan, Acetonitril, Tetrahydrofuran, Ethylenglykoldimethylether, 1,2-Dimethoxypropan, Tetramethylsulfon, Hexamethylphosphoramid, Methylethylketon, Methylisobutylketon, Aceton oder Gemische davon ist.

8. Verfahren nach Anspruch 5 oder 6 worin

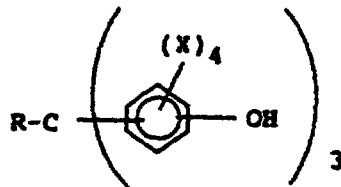
(a) das eine Mehrzahl von aromatischen Hydroxylgruppen enthaltende Material ein Material ist, dargestellt durch die folgenden Formeln V, VI oder VII



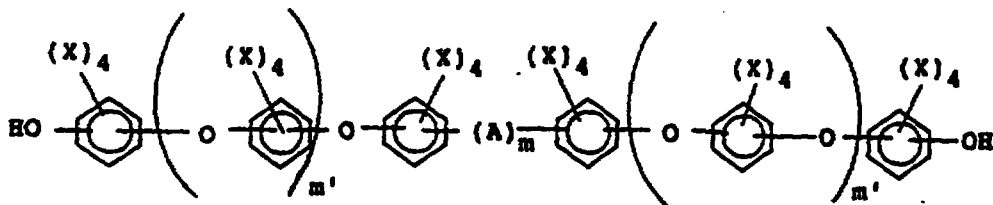
(V)



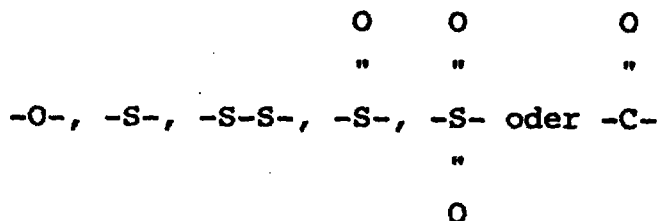
(VI)



(VII)



worin A eine Kohlenwasserstoffgruppe mit 1 bis 15 Kohlenstoffatomen,



ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 6 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 6 Kohlenstoffatomen oder ein Halogenatom, vorzugsweise Brom, ist, jedes m unabhängig einen Wert von 0 oder 1 besitzt und m' einen Wert von 0 bis 50 besitzt,

(b) das Ausdehnungsmaterial 4-Brommethyl-3,5-dibrom-2,6-dimethylphenol, 1,2-Bis(brommethyl)benzol, 1,3-Bis(brommethyl)benzol, 1,4-Bis(brommethyl)benzol, 1,2-Bis(chlormethyl)benzol, 1,3-Bis(chlormethyl)benzol, 1,4-Bis(chlormethyl)benzol, 2,4-Bis(chlormethyl)mesitylen, 4,6-Bis(chlormethyl)-m-xylol, 2,5-Bis(chlormethyl)-p-xylol und Kombinationen davon ist,

(c) das Vinylbenzylhalogenid Vinylbenzylchlorid oder Vinylbenzylbromid ist und

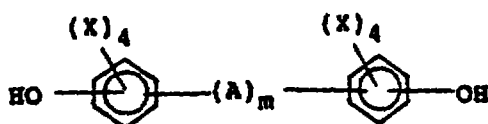
(d) das polare aprotische Lösungsmittel Dimethylformamid, Dimethylacetamid, Dimethylsulfoxid, N-Methylpyrrolidon, Dioxan, Acetonitril, Tetrahydrofuran, Ethylenglykoldimethylether, 1,2-Dimethoxypropan, Tetramethylsulfon, Hexamethylphosphoramid, Methylethylketon, Methylisobutylketon, Aceton oder Gemische davon ist.

9. Verfahren nach Anspruch 5 oder 6, worin

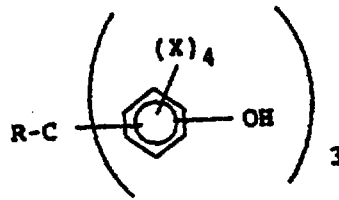
(a) das eine Mehrzahl von aromatischen Hydroxylgruppen enthaltende Material ein Material ist, dargestellt durch die folgenden Formeln V, VI oder VII



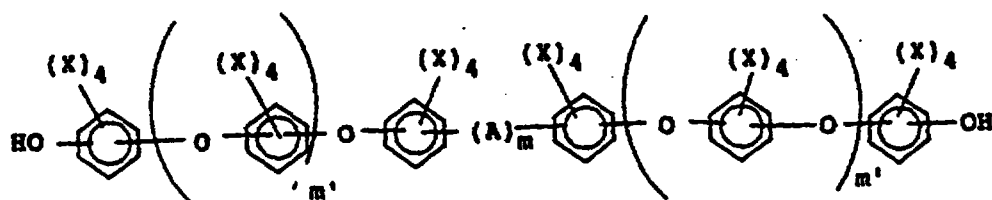
(V)



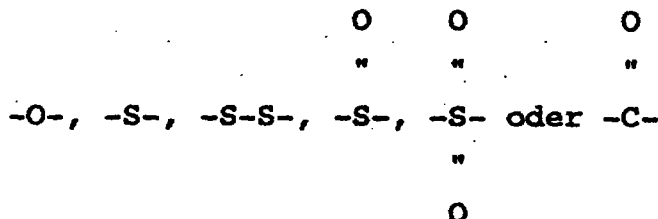
(VI)



(VII)



worin A eine Kohlenwasserstoffgruppe mit 1 bis 10 Kohlenstoffatomen,



ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 4 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 4 Kohlenstoffatomen oder ein Halogenatom, vorzugsweise Brom, ist, jedes m unabhängig einen Wert von 0 oder 1 besitzt und m' einen Wert von 0 bis 20 besitzt.

(b) das Ausdehnungsmaterial 4-Brommethyl-3,5-dibrom-2,6-dimethylphenol, 1,2-Bis(brommethyl)benzol, 1,3-Bis(brommethyl)benzol, 1,4-Bis(brommethyl)benzol, 1,2-Bis(chlormethyl)benzol, 1,3-Bis(chlormethyl)benzol, 1,4-Bis(chlormethyl)benzol, 2,4-Bis(chlormethyl)mesitylen, 4,6-Bis(chlormethyl)-m-xylol, 2,5-Bis(chlormethyl)-p-xylol und Kombinationen davon ist,

(c) das Vinylbenzylhalogenid Vinylbenzylchlorid oder Vinylbenzylbromid ist und

(d) das polare aprotische Lösungsmittel Dimethylformamid, Dimethylacetamid, Dimethylsulfoxid, N-Methylpyrrolidon, Dioxan, Acetonitril, Tetrahydrofuran, Ethylenglykoldimethylether, 1,2-Dimethoxypropan, Tetramethylsulfon, Hexamethylphosphoramid, Methyläthylketon, Methylisobutylketon, Aceton oder Gemische davon ist.

10. Verfahren nach einem der Ansprüche 5 bis 9, worin die Reaktion bei (1) einer Temperatur von -30°C bis 100°C für 0,5 bis 20 Stunden, (2) einer Temperatur von 0°C bis 80°C für 0,5 bis 15 Stunden oder (3) einer Temperatur von 15°C bis 60°C für 0,5 bis 6 Stunden durchgeführt wird.

11. Vernetzbare Zusammensetzung, die ein Monomer oder Oligomer nach einem der Ansprüche 1 bis 3 enthält.

12. Vernetzbare Zusammensetzung nach Anspruch 11, weiterhin ein vernetzbares Harz enthaltend, ausge-

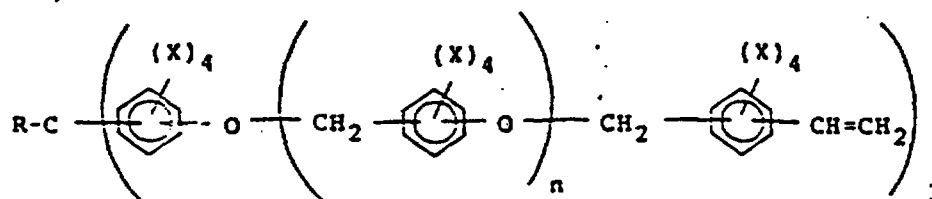
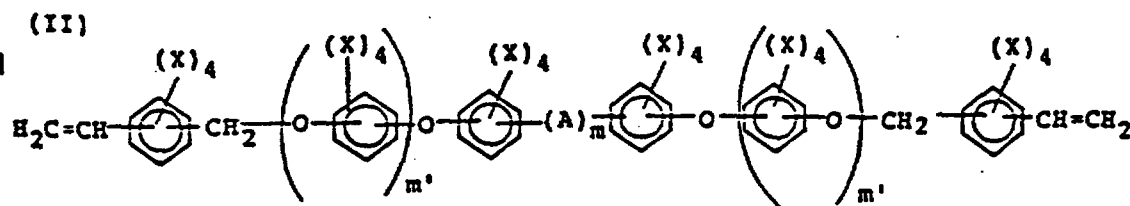
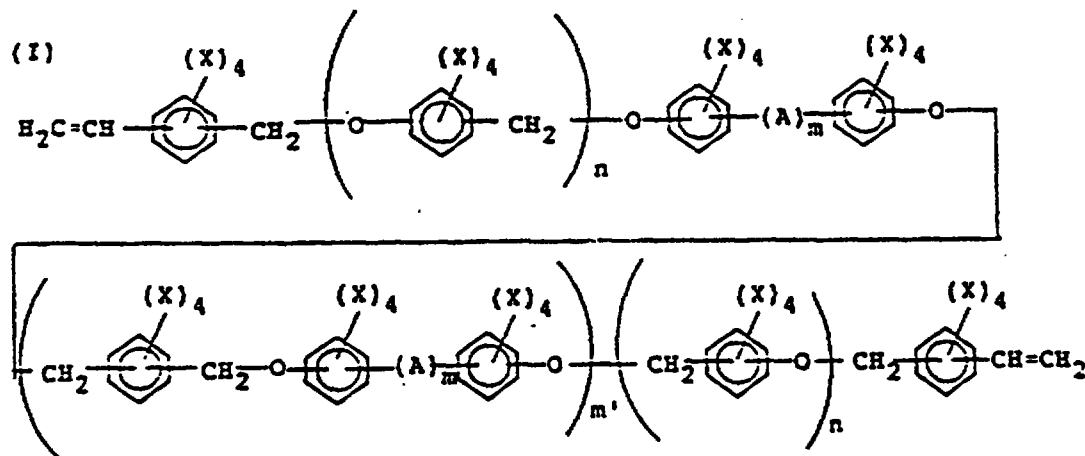




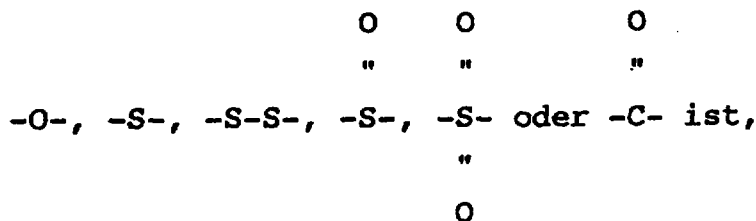
wählt aus der Gruppe, bestehend aus Bismaleimid, Polycyanaten von Polyphenolen, Polypropargylethern von Polyphenolen, Epoxiden und Gemischen davon.

Patentansprüche für folgende Vertragsstaaten : AT, ES

1. Verfahren zur Herstellung eines Monomers oder Oligomers, das eine Mehrzahl von Vinylarylethergruppen enthält, dargestellt durch die folgenden Formeln I, II oder III

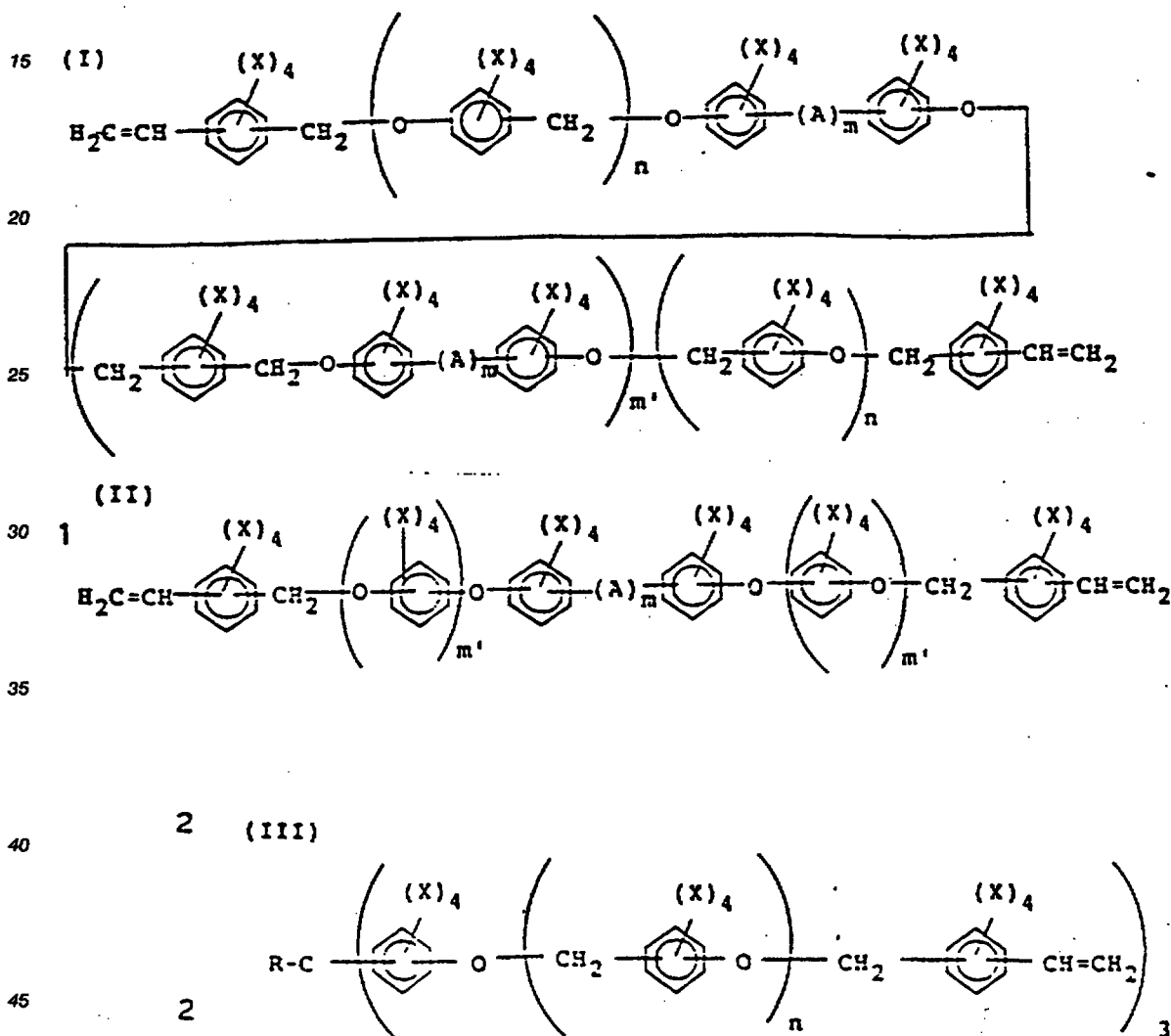


worin A eine Kohlenwasserstoffgruppe mit 1 bis 25 Kohlenstoffatomen,



R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasser-

- stoffgruppe mit 1 bis 12 Kohlenstoffatomen oder ein Halogenatom ist, m' einen Wert von 0 bis 200 besitzt, jedes m und n unabhängig einen Wert von 0 oder 1 besitzt, unter der Voraussetzung, daß A eine Dicyclopentadienylgruppe oder eine Dicyclopentadienyl-Oligomergruppe ist, wenn m' und n einen Wert von 0 besitzen, umfassend das Umsetzen von mindestens einem Alkalimetallphenoxid eines Materials, das eine Mehrzahl von aromatischen Hydroxylgruppen enthält, mit einem Vinylbenzylhalogenid in Gegenwart eines polaren aprotischen Lösungsmittels und anschließendes Gewinnen eines Materials daraus, bei dem mehr als 95 % der aromatischen Hydroxylgruppen in Vinylbenzylethergruppen umgewandelt worden sind.
2. Verfahren zur Herstellung eines Monomers oder Oligomers, das eine Mehrzahl von Vinylarylethergruppen enthält, dargestellt durch die folgenden Formeln I, II oder III,



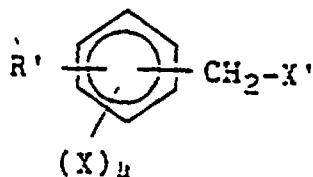
worin A eine Kohlenwasserstoffgruppe mit 1 bis 25 Kohlenstoffatomen,

O O O
 '' '' ''
 $-\text{O}-, -\text{S}-, -\text{S}-\text{S}-, -\text{S}-, -\text{S}-$ oder $-\text{C}-$ ist,
 ''
 O



R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen oder ein Halogenatom ist, m' einen Wert von 0 bis 200 besitzt, jedes m und n unabhängig einen Wert von 0 oder 1 besitzt, unter der Voraussetzung, daß A eine Dicyclopentadienylgruppe oder eine Dicyclopentadienyl-Oligomergruppe ist, wenn m' und n einen Wert von 0 besitzen, umfassend (A) Umsetzen von mindestens einem Alkalimetallphenoxid eines Materials, das eine Mehrzahl von aromatischen Hydroxylgruppen enthält, mit mindestens einem Kettenausdehnungsmaterial, dargestellt durch die folgende Formel IV

(IV)

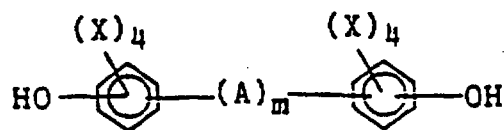


worin R' eine Hydroxylgruppe oder eine $-\text{CH}_2\text{X}'$ -Gruppe ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen oder ein Halogenatom ist und X' ein Halogen ist, in Gegenwart eines polaren aprotischen Lösungsmittels und dann (B) Umsetzen des Alkalimetallphenoxids des resultierenden Produkts mit einem Vinylbenzylhalogenid in Gegenwart eines polaren aprotischen Lösungsmittels und anschliessende Gewinnung eines Materials daraus, bei dem mehr als 95 % der aromatischen Hydroxylgruppen in Vinylbenzylethergruppen umgewandelt worden sind.

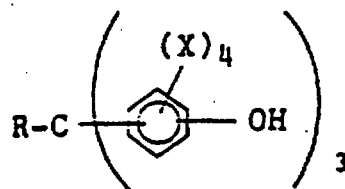
3. Verfahren nach Anspruch 1 oder 2, worin A eine Kohlenwasserstoffgruppe mit 1 bis 15 Kohlenstoffatomen ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 6 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 6 Kohlenstoffatomen oder ein Halogenatom ist, jedes m und n unabhängig einen Wert von 0 oder 1 hat und m' einen Wert von 0 bis 50 hat.
4. Verfahren nach Anspruch 1 oder 2, worin A eine Kohlenwasserstoffgruppe mit 1 bis 10 Kohlenstoffatomen ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 4 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 4 Kohlenstoffatomen oder ein Halogenatom ist und m' einen Wert von 0 bis 20 hat.
5. Verfahren nach Anspruch 1 oder 2, worin das Monomer oder Oligomer aus der Gruppe, bestehend aus Bis(vinylbenzyl)ether von Dicyclopentadienyl-bis(2,6-dimethylphenol), Bis(vinylbenzyl)ether von Dicyclopentadienyl-bis(o-cresol) ausgewählt ist.
6. Verfahren nach Anspruch 1 oder 2, worin
 - (a) das eine Mehrzahl von aromatischen Hydroxylgruppen enthaltende Material ein Material ist, dargestellt durch die folgenden Formeln V, VI oder VII



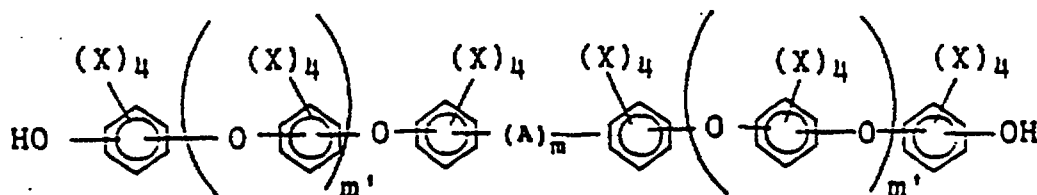
(V)



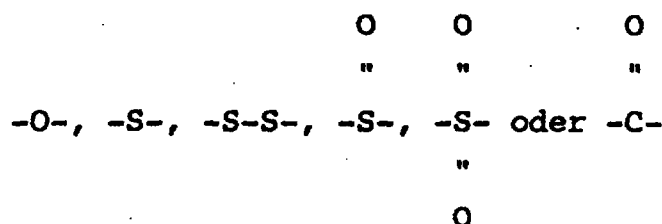
(VI)



(VII)



worin A eine Kohlenwasserstoffgruppe mit 1 bis 25 Kohlenstoffatomen,



ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 12 Kohlenstoffatomen oder ein Halogenatom ist, jedes m unabhängig einen Wert von 0 oder 1 besitzt und m' einen Wert von 0 bis 200 besitzt,

(b) das Ausdehnungsmaterial 4-Brommethyl-3,5-dibrom-2,6-dimethylphenol, 2,4-Bis(chlormethyl)mesitylen, 1,2-Bis(brommethyl)benzol, 1,3-Bis(brommethyl)benzol, 1,4-Bis(brommethyl)benzol, 1,2-Bis(chlormethyl)benzol, 1,3-Bis(chlormethyl)benzol, 1,4-Bis(chlormethyl)benzol, 4,6-Bis(chlormethyl)-m-xylol, 2,5-Bis(chlormethyl)-p-xylol und Kombinationen davon ist,

(c) das Vinylbenzylhalogenid Vinylbenzylchlorid oder Vinylbenzylbromid ist und

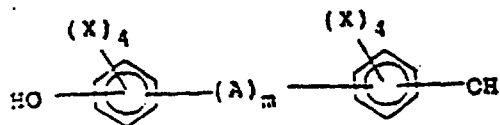
(d) das polare aprotische Lösungsmittel Dimethylformamid, Dimethylacetamid, Dimethylsulfoxid, N-Methylpyrrolidon, Dioxan, Acetonitril, Tetrahydrofuran, Ethylenglykoldimethylether, 1,2-Dimethoxypropan, Tetramethylsulfon, Hexamethylphosphoramid, Methyläthylketon, Methylisobutylketon, Aceton oder Gemische davon ist.

7. Verfahren nach Anspruch 1 oder 2, worin

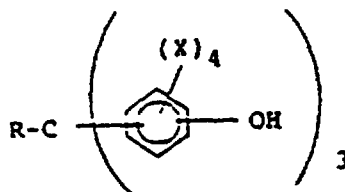


(a) das eine Mehrzahl von aromatischen Hydroxylgruppen enthaltende Material ein Material ist, dargestellt durch die folgenden Formeln V, VI oder VII

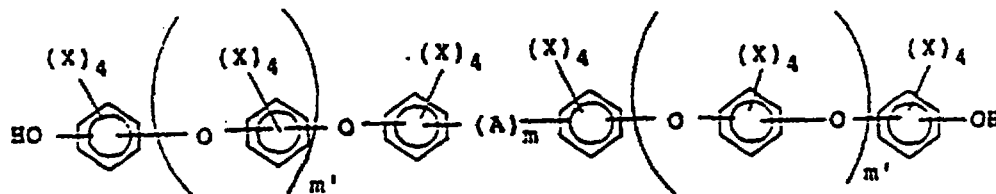
(V)



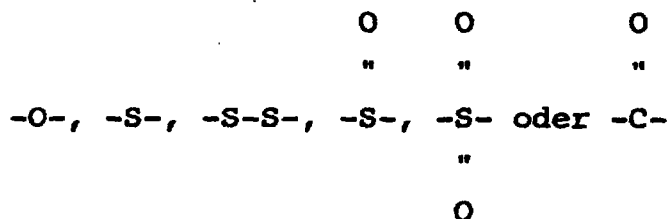
(VI)



(VII)



worin A eine Kohlenwasserstoffgruppe mit 1 bis 15 Kohlenstoffatomen,



ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 6 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 6 Kohlenstoffatomen oder ein Halogenatom, vorzugsweise Brom ist, jedes m unabhängig einen Wert von 0 oder 1 besitzt und m' einen Wert von 0 bis 50 besitzt,

(b) das Ausdehnungsmaterial 4-Brommethyl-3,5-dibrom-2,6-dimethylphenol, 1,2-Bis(brommethyl)benzol, 1,3-Bis(brommethyl)benzol, 1,4-Bis(brommethyl)benzol, 1,2-Bis(chlormethyl)benzol, 1,3-Bis(chlormethyl)benzol, 1,4-Bis(chlormethyl)benzol, 2,4-Bis(chlormethyl)mesitylen, 4,6-Bis(chlormethyl)-m-xylol, 2,5-Bis(chlormethyl)-p-xylol und Kombinationen davon ist,

(c) das Vinylbenzylhalogenid Vinylbenzylchlorid oder Vinylbenzylbromid ist und

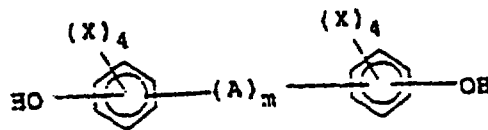
(d) das polare aprotische Lösungsmittel Dimethylformamid, Dimethylacetamid, Dimethylsulfoxid, N-Methylpyrrolidon, Dioxan, Acetonitril, Tetrahydrofuran, Ethylenglykoldimethylether, 1,2-Dimethoxypropan, Tetramethylsulfon, Hexamethylphosphoramid, Methylalkylketon, Methylisobutylketon, Aceton oder Gemische davon ist.



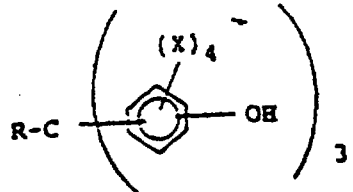
8. Verfahren nach Anspruch 1 oder 2, worin

(a) das eine Mehrzahl von aromatischen Hydroxylgruppen enthaltende Material ein Material ist, dargestellt durch die folgenden Formeln V, VI oder VII

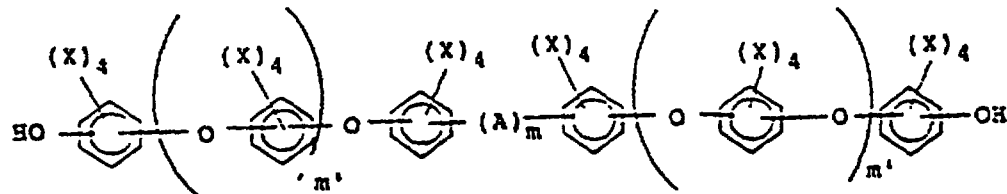
(V)



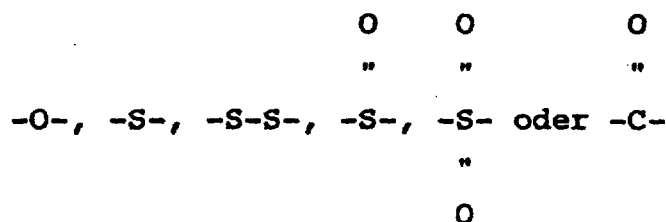
(VI)



(VII)



worin A eine Kohlenwasserstoffgruppe mit 1 bis 10 Kohlenstoffatomen,



ist, R Wasserstoff oder eine Kohlenwasserstoffgruppe mit 1 bis 4 Kohlenstoffatomen ist, jedes X unabhängig Wasserstoff, eine Kohlenwasserstoff- oder eine mit Sauerstoff substituierte Kohlenwasserstoffgruppe mit 1 bis 4 Kohlenstoffatomen oder ein Halogenatom, vorzugsweise Brom, ist, jedes m unabhängig einen Wert von 0 oder 1 besitzt und m' einen Wert von 0 bis 20 besitzt,

(b) das Ausdehnungsmaterial 4-Brommethyl-3,5-dibrom-2,6-dimethylphenol, 1,2-Bis(brommethyl)benzol, 1,3-Bis(brommethyl)benzol, 1,4-Bis(brommethyl)benzol, 1,2-Bis(chlormethyl)benzol, 1,3-Bis(chlormethyl)benzol, 1,4-Bis(chlormethyl)benzol, 2,4-Bis(chlormethyl)mesitylen, 4,6-Bis(chlormethyl)-m-xylol, 2,5-Bis(chlormethyl)-p-xylol und Kombinationen davon ist,

(c) das Vinylbenzylhalogenid Vinylbenzylchlorid oder Vinylbenzylbromid ist und

(d) das polare aprotische Lösungsmittel Dimethylformamid, Dimethylacetamid, Dimethylsulfoxid, N-Methylpyrrolidon, Dioxan, Acetonitril, Tetrahydrofuran, Ethylenglykoldimethylether, 1,2-Dimethoxypropan, Tetramethylsulfon, Hexamethylphosphoramid, Methyläthylketon, Methylisobutylketon, Aceton oder Gemische davon ist.

9. Verfahren nach einem der Ansprüche 1 bis 8, worin die Reaktion bei (1) einer Temperatur von -30°C 

bis 100° C für 0,5 bis 20 Stunden, (2) einer Temperatur von 0° C bis 80° C für 0,5 bis 15 Stunden oder (3) einer Temperatur von 15° C bis 60° C für 0,5 bis 6 Stunden durchgeführt wird.

10. Verwendung eines Monomers oder Oligomers, das nach einem der Ansprüche 1 bis 4 hergestellt worden ist, zur Herstellung einer vernetzbaren Zusammensetzung.
11. Verwendung eines Monomers oder Oligomers nach Anspruch 10 zusammen mit einem vernetzbaren Harz, ausgewählt aus der Gruppe, bestehend aus Bismaleimid, Polycyanaten von Polyphenolen, Polypropargylethern von Polyphenolen, Epoxiden und Gemischen davon.

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