WO10/092824

Patent Document 11: Japanese Patent Laid-open Publication No. 2011-191749

Patent Document 12: International Publication No. WO04/109403

Patent Document 13: Japanese Patent Laid-open Publication No. 2007-106859

Patent Document 14: US Patent No. 5,378,420

Patent Document 15: Chinese Patent Application Publication No. 200780002686.6

NON-PATENT DOCUMENTS

[0011]

Non-Patent Document 1: Progress in Polymer Science (2012), 37(7), 907-974

Non-Patent Document 2: Synthesis, 2000, 383-388

SUMMARY

PROBLEMS TO BE SOLVED

[0012]

However, in the above resin having a small linear thermal expansion coefficient, there is a problem that due to the rigid skeleton introduced into the main chain, the absorbance, particularly the absorbance of an i-line (light having a wavelength of 365 nm) currently widely used for pattern processing a photosensitive resin, is high, and it is difficult

to impart good photosensitive characteristics due to energy loss caused by absorption of the resin itself.

[0013]

A further object is to produce, as a monomer for synthesizing polyimide, a low-cost hydroxyl group-containing diamine monomer in which a hydroxyl group is introduced into a 4,4'-diaminobiphenyl derivative monomer.

[0014]

Further, regarding a dibromobiphenyl derivative used for this, the yield is very low according to the method disclosed in Patent Document 15, and there is a problem that it is not suitable for mass production. Furthermore, according to the method disclosed in Non-Patent Document 2, the degree of corrosion to equipment is relatively large due to use of acidic solvent and salt, recovery of solvent is difficult, difficulty in post-treatment is increased, and there is a problem of environmental pollution.

[0015]

In view of the above-described problems of the prior art, an object of the embodiments disclosed hereinis to provide a resin having a small linear thermal expansion coefficient and a low absorbance.

[0016]

A further object is to provide a production process including highly selectively introducing a bromine atom into

a 5,5'-dihydroxyl-4,4'-diaminobiphenyl derivative used in these resins and a 5,5' position, at the same time, simplifying a process for post-treating a bromination reaction, obtaining a 5,5'-dibromo-4,4'-diaminobiphenyl derivative, and then converting the bromine atom into a hydroxyl group by a reaction of an oxazole ring and a ring opening reaction. A furthermore object is to provide a method for synthesizing dibromobiphenyl derivatives used for this, easily achieving high yield, low cost, and mass production, and hardly polluting the environment.

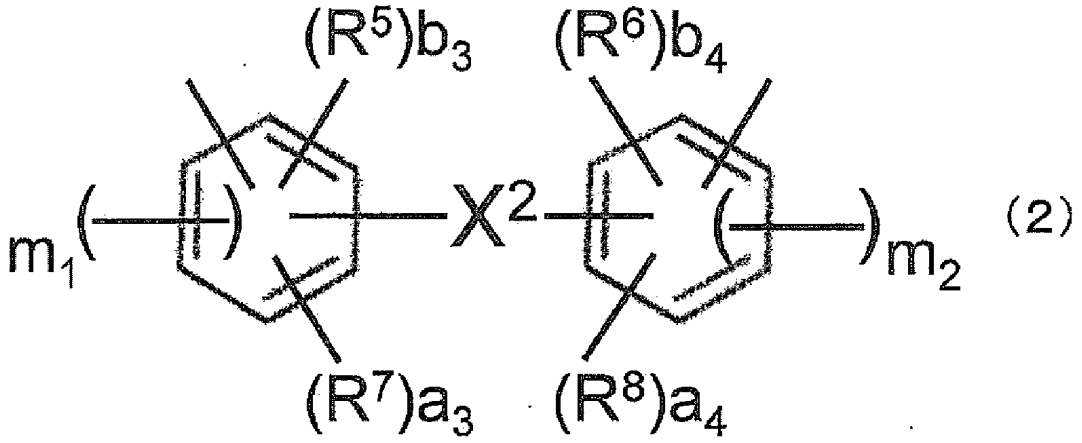
SOLUTIONS TO THE PROBLEMS

[0017]

As a result of intensive studies to solve the above problems, the inventors have found the present disclosure. That is, in an aspect, there is provided a resin comprising at least one structure selected from the structures represented by the following general formulae (1) and (2).

[0018]

[Chemical Formula 1]



(2)

[0021]

(The general formula (2) is a trivalent or tetravalent organic group, and R^5 and R^6 each independently represent a halogen atom or a monovalent organic group having 1 to 3 carbon atoms. R^7 and R^8 each represent an organic group selected from a hydroxyl group, a carboxyl group and a sulfonic acid group. X^2 is a single bond, O, S, NH, SO_2, CO or a divalent organic group having 1 to 3 carbon atoms or a divalent crosslinked structure formed by linking two or more of these. a_3, a_4, b_3 and b_4 are integers of 0 to 3, $a_3 + b_3$ is an integer of 0 to 3, $a_4 + b_4$ is an integer of 0 to 3, at least one of a_3 and a_4 is an integer of 1 or more, and at least one of b_3 and b_4 is an integer of 1 or more. m_1 and m_2 are integers of 0 or 1, and $m_1 + m_2$ is an integer of 1 or 2.)

[0021a]

In another aspect, there is provided a resin composition comprising the resin as defined above.

[0021b]

In another aspect, there is provided a process for producing

a heat resistance coating film, comprising: coating the resin composition as defined above onto a support substrate to form a coating film; drying the coating film to form a resin film; exposing the resin film; developing the exposed resin film; and applying heat treatment to the developed resin film.

[0021c]

In another aspect, there is provided a process for producing a heat resistance coating film, comprising: coating the resin composition as defined above onto a support substrate using a slit nozzle to form a coating film; drying the coating film under reduced pressure to form a resin film; exposing the resin film; developing the exposed resin film; and applying heat treatment to the developed resin film.

[0021d]

In another aspect, there is provided an electronic component mounted in such a state that one or a plurality of structures comprising a substrate and a coating film provided on one or both surfaces of the substrate are stacked, the coating film is a heat resistance coating film obtained by the production process as defined above.

[0021e]

In another aspect, there is provided an electronic component comprising a substrate, a rewiring structure comprising a coating film layer and a wiring layer alternately formed on the substrate, or a multilayer wiring structure, wherein the

coating film layer is a heat resistance coating film obtained by the production process as defined above.

[0021f]

In another aspect, there is provided a display device comprising a first electrode provided on a substrate, an insulating layer provided on the first electrode such that the first electrode is partially exposed, and a second electrode provided facing the first electrode, wherein the insulating layer is a heat resistance coating film obtained by the production process as defined above.

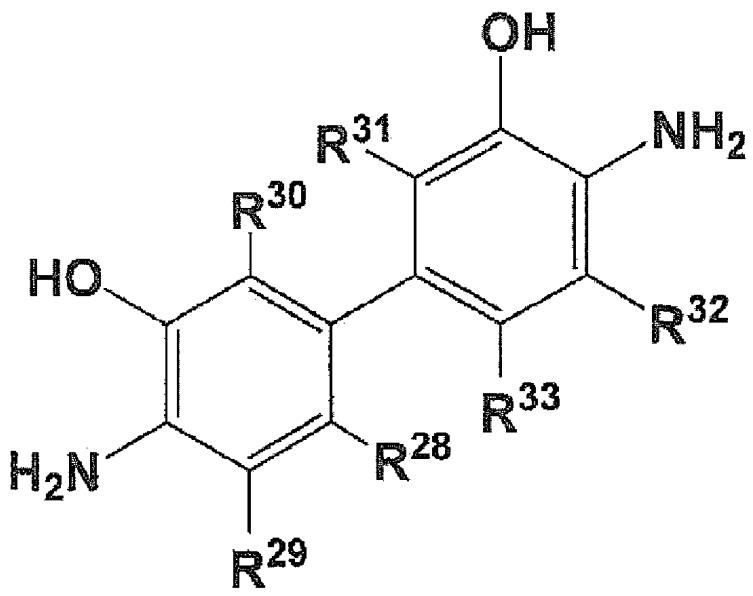
[0021g]

In another aspect, there is provided a display element comprising a flattening film provided to cover concavoconvexes on a substrate comprising a thin film transistor (TFT) and a display element provided on the flattening film, wherein the flattening film is a heat resistance coating film obtained by the production process as defined above.

[0021h]

In another aspect, there is provided a 5,5'-dihydroxyl-4,4'-diaminobiphenyl derivative represented by the following general formula (8).

[Chemical Formula 8]



(8)

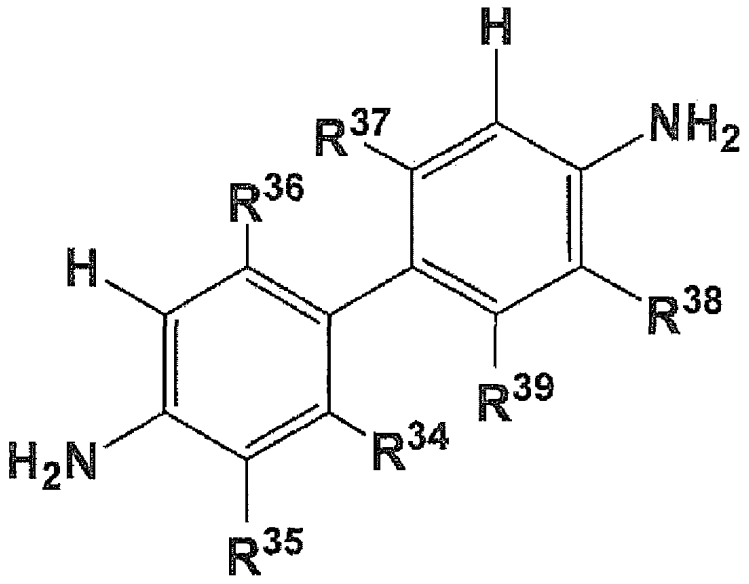
(wherein R^{28} and R^{33} are the same and independently one kind selected from the group consisting of a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group, an ester group and a nitro group. R^{29} and R^{32} are the same, R^{30} and R^{31} are the same, and they are each one kind selected from the group consisting of hydrogen, halogen, a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or

unsubstituted amide group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group, an ester group and a nitro group. Among them, the substituents may be the same or different and represent one or more of halogen, trifluoromethyl, trimethylsilyl, a C_1 to C_6 alkoxyl group, a C_1 to C_6 alkyl group, an aryl alkoxyl group, a C_6 to C_{30} aryl group, and a C_4 to C_{30} heterocyclic group.)

[0021i]

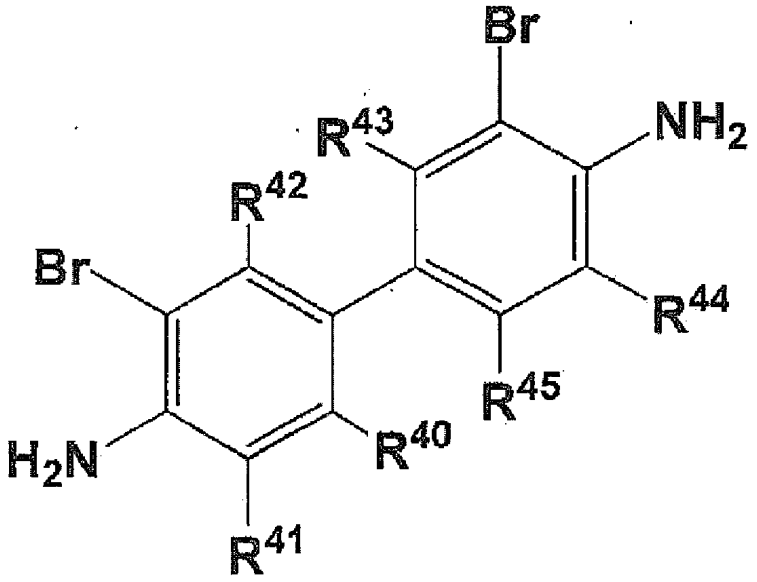
In another aspect, there is provided a process for producing a 5,5'-dihydroxy-4,4'-diaminobiphenyl derivative, comprising a production process for obtaining a 5,5'-dibromo-4,4'-diaminobiphenyl derivative of the general formula (10) by bromination reaction of 4,4'-diaminobiphenyl of the general formula (9).

[Chemical Formula 9]



(9)

[Chemical Formula 10]



(10)

(wherein R^{34} and R^{39} are the same and each independently one kind selected from the group consisting of a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino

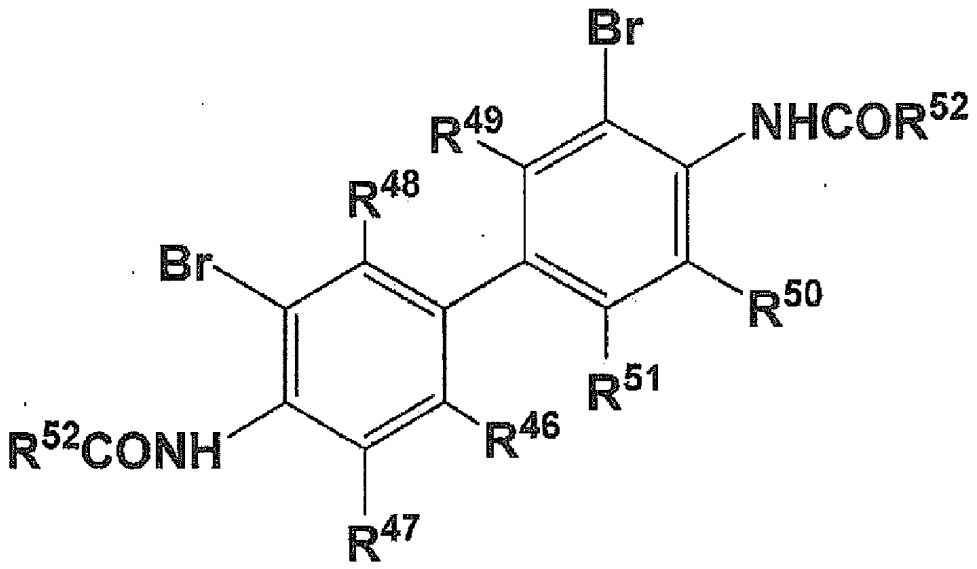
group, a substituted or unsubstituted amide group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group, an ester group and a nitro group. R^{35} and R^{38} are the same, R^{36} and R^{37} are the same, and they are each independently one kind selected from the group consisting of hydrogen, halogen, a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group, an ester group and a nitro group. R^{40} and R^{45} are the same and each independently one kind selected from the group consisting of a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group, an ester group and a nitro group. R^{41} and R^{44} are the same, R^{42} and R^{43} are the same, and they are each independently one kind selected from the group consisting of hydrogen, halogen, a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a

halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group, an ester group and a nitro group. The substituents may be the same or different and each independently represent one or more of halogen, trifluoromethyl, trimethylsilyl, a C_1 to C_6 alkoxyl group, a C_1 to C_6 alkyl group, an aryl alkoxyl group, a C_6 to C_{30} aryl group, and a C_4 to C_{30} heterocyclic group.)

[0021j]

In another aspect, there is provided a process for producing a 5,5'-dihydroxy-4,4'-diaminobiphenyl derivative, comprising a production process for obtaining a 5,5'-dibromo-4,4'-diamidebiphenyl derivative of the general formula (11) by amidation reaction of a 5,5'-dibromo-4,4'-diaminobiphenyl derivative using acid anhydride or acyl chloride.

[Chemical Formula 11]



(11)

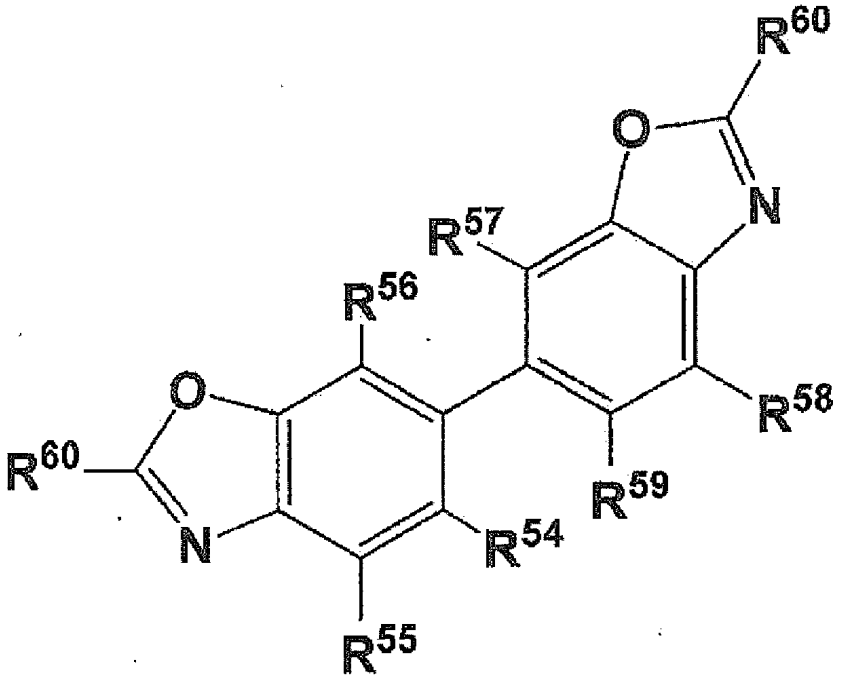
(R^{46} and R^{51} are the same and each independently one kind selected from the group consisting of a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group, an ester group and a nitro group. R^{47} and R^{50} are the same, R^{48} and R^{49} are the same, and they are each independently one kind selected from the group consisting of hydrogen, halogen, a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group,

an ester group and a nitro group. Among them, the substituents may be the same or different and each independently represent one or more of halogen, trifluoromethyl, trimethylsilyl, a C_1 to C_6 alkoxyl group, a C_1 to C_6 alkyl group, an aryl alkoxyl group, a C_6 to C_{30} aryl group, and a C_4 to C_{30} heterocyclic group, and R^{52} is one kind selected from the group consisting of a substituted or unsubstituted C_1 to C_6 alkyl group or a substituted or unsubstituted aryl group. The substituent in R^{52} is one or more of a methyl group, a sulfo group, a fluorine atom, an amino group, and a methoxy group.)

[0021k]

In another aspect, there is provided a process for producing a 5,5'-dihydroxy-4,4'-diaminobiphenyl derivative, comprising a production process for obtaining a 6,6'-dibenzoxazole derivative represented by the general formula (12) by reaction of a 5,5'-dibromo-4,4'-diamidobiphenyl derivative under the action of a catalyst and inorganic alkali.

[Chemical Formula 12]



(12)

(R^{54} and R^{59} are the same and each independently one kind selected from the group consisting of a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group, an ester group and a nitro group. R^{55} and R^{58} are the same, R^{56} and R^{57} are the same, and they are each independently one kind selected from the group consisting of hydrogen, halogen, a substituted or unsubstituted C_1 to C_6 alkyl group, a substituted or unsubstituted C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide

group, a substituted or unsubstituted C_6 to C_{30} aryl group, a substituted or unsubstituted C_4 to C_{30} heterocyclic aryl group, an ester group and a nitro group. One or more substituents among them may be the same or different and are each independently represent one or more of halogen, trifluoromethyl, trimethylsilyl, a C_1 to C_6 alkoxyl group, a C_1 to C_6 alkyl group, an arylalkoxyl group, a C_6 to C_{30} aryl group, and a C_4 to C_{30} heterocyclic group. R^{60} is one kind selected from the group consisting of a substitutable C_1 to C_6 alkyl group and a substitutable aryl group. The substituent in R^{60} is one or more of a methyl group, a sulfo group, a fluorine atom, an amino group, and a methoxy group.)

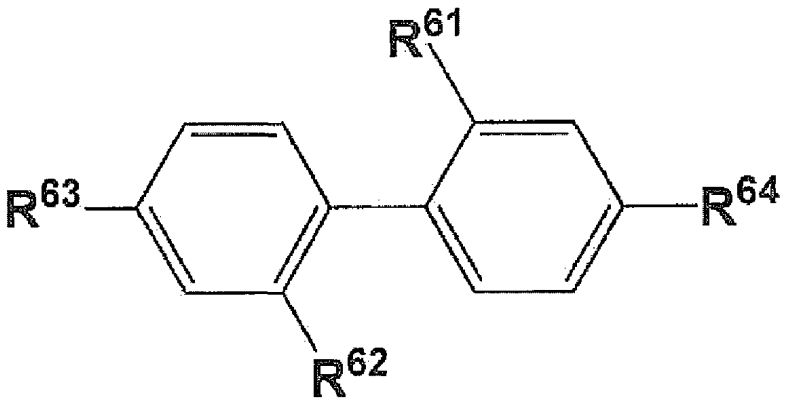
[0021l]

In another aspect, there is provided a process for producing a 5,5'-dihydroxy-4,4'-diaminobiphenyl derivative characterized by obtaining a 6,6'-dibenzoxazole derivative by ring-opening reaction under an inorganic strong acid.

[0021m]

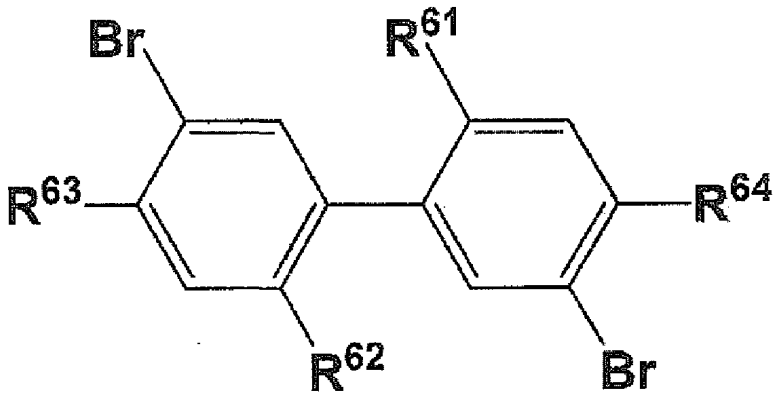
In another aspect, there is provided a process for producing a 5,5'-dibromobiphenyl derivative characterized by obtaining a 5,5'-dibromobiphenyl derivative having a structure represented by the general formula (14) under the action of an aprotic solvent and a bromination reagent, using a biphenyl compound having a structure represented by the general formula (13) as a raw material.

[Chemical Formula 13]



(13)

[Chemical Formula 14]



(14)

(R^{61} and R^{62} may be the same or different and are each one kind selected from the group consisting of hydrogen, halogen, a C_1 to C_6 alkyl group, a C_1 to C_6 alkoxyl group, a hydroxyl group, a halogenated alkyl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide group, a substituted or unsubstituted aryl group, an ester group and a nitro group. R^{63} and R^{64} may be the same or different and are each one kind selected from the group consisting of a C_1 to C_6 alkyl group, a C_1 to C_6 alkoxyl group, a hydroxyl group, a

substituted or unsubstituted aryl group, a substituted or unsubstituted amino group, a substituted or unsubstituted amide group, a substituted or unsubstituted imide group, a substituted or unsubstituted sulfamine group, a substituted or unsubstituted sulfinamide group, and a substituted or unsubstituted aromatic heterocyclic group. Among them, the substituents may be the same or different and represent one or more of trifluoromethyl, trimethylsilyl, a C_1 to C_6 alkoxyl group, a C_1 to C_6 alkyl group, an aryl alkoxyl group, a C_6 to C_{30} aryl group, and a heterocyclic group.)

EFFECTS [0022]

According to the present disclosure, it is possible to obtain a resin having a low linear thermal expansion coefficient