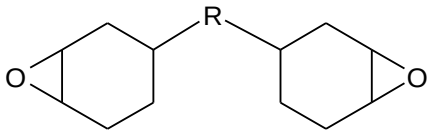
CLAIMS

1. An ink-jet print head comprising a polymeric material layer defining ink passage ways formed on a substrate, said polymeric material layer being formed by curing a curable resin composition comprising

(a) a cyclic aromatic difunctional epoxy resin obtained by the condensation of bisphenol A and epichlorohydrine having a weight per epoxide (EEW) of at least 400 g/eq.,

(b) a cyclic aliphatic difunctional epoxy resin represented by the following general formula:



wherein R is a carboxyalkylene group of formula $-(CH_2)_p-COO-$ or $-(CH2)_q-$ $COO-(CH_2)_r-OOC-(CH_2)_s-$ and p, q, r, and s each independently is an integer of from 1 to 9, and

(c) a polymerization initiator.

2. The ink-jet print head according to claim 1, wherein said cyclic aromatic difunctional epoxy resin has a weight per epoxide (EEW) lower than 1,000 g/eq.

~~3. The ink-jet print head according to claim 1, wherein said cyclic aromatic difunctional epoxy resin has a weight per epoxide (EEW) ranging between 500 and 800 g/eq.~~

34. The ink-jet print head according to claim 1, wherein said cyclic aromatic difunctional epoxy resin is selected from the group consisting of commercial cyclic aromatic difunctional epoxy resins.

~~distributed under the trade name Epikote 1001, 1001 MSQ, 1002 and 1003 (by Hexion Specialty Chemicals, Inc.), Araldite 6071, 7071 and 7072 (by Huntsman Corporation), and Dow Epoxy DER 661, 662E, 671, 692, 692H and 692HB (Dow Chemical Company).~~

45. The ink-jet print head according to claim 1, wherein said curable resin composition comprises less than 40% by weight, more preferably less than 30% by weight, of said cyclic aromatic difunctional epoxy resin based on the total weight of said curable resin composition.

~~6. The ink-jet print head according to claim 5, wherein said curable resin composition comprises at least 5% by weight, more preferably at least 10% by weight, of said cyclic aromatic difunctional epoxy resin based on the total weight of said curable resin composition.~~

~~7. The ink-jet print head according to claim 1, wherein p, q, r, and s each independently is an integer of from 1 to 5.~~

~~8. The ink-jet print head according to claim 1, wherein R is a carboxyalkylene group of formula $-CH_2-COO-$, $-(CH_2)_2-COO-$, $-(CH_2)_3-COO-$, $-(CH_2)_4-COO-$, $-CH_2-COO-CH_2-OOC-CH_2-$, $-(CH_2)_2-COO-CH_2-OOC-(CH_2)_2-$, $-(CH_2)_3-COO-CH_2-OOC-(CH_2)_3-$, $-(CH_2)_3-COO-(CH_2)_2-OOC-(CH_2)_3-$.~~

95. The ink-jet print head according to claim 1, wherein said curable resin composition comprises less than 50% by weight, more preferably less than 40% by weight, of said cyclic aliphatic difunctional epoxy resin based on the total weight of said curable resin composition.

~~10. The ink-jet print head according to claim 1, wherein said curable resin composition comprises at least 10% by weight, more preferably at least 20% by weight, of the cyclic aliphatic difunctional epoxy resin based on the total weight of said curable resin composition.~~

611. The ink-jet print head according to claim 1, wherein said polymerization initiator is a photoinitiator.

712. The ink-jet print head according to claim ~~11~~6, wherein said photoinitiator is a cationic photoinitiator.

~~13. The ink-jet print head according to claim 12, wherein said photoinitiator is selected from the group consisting of aryldiazonium salts, diaryl iodonium salts, triaryl sulfonium salts, dialkyl phenacyl sulfonium salts and dialkyl-4-hydroxyphenyl sulfonium salts, Fe-arene compounds, and silanol-aluminum complexes.~~

~~14. The ink-jet print head according to claim 13, wherein said photoinitiator is selected from the group consisting of aromatic iodonium salts and aromatic sulfonium salts.~~

~~15. The ink-jet print head according to claim 14, wherein said photoinitiator is selected from the group consisting of arylsulfonium hexafluorophosphate and triarylsulfonium hexafluorophosphate.~~

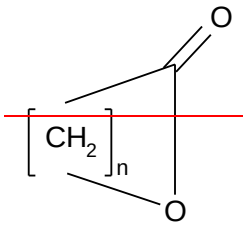
8~~16~~. The ink-jet print head according to claim ~~11~~6, wherein said curable resin composition comprises from 1 to 10 weight percent of said photoinitiator based on the total weight of said curable resin composition.

~~17. The ink-jet print head according to claim 16, wherein said curable resin composition comprises from 1 to 5 weight percent of said polymerization initiator based on the total weight of said curable resin composition.~~

9~~18~~. The ink-jet print head according to claim 1, wherein said curable resin composition comprises a non photoreactive thermal polymerizable compound.

10~~9~~. The ink-jet print head according to claim ~~1~~9, wherein said non photoreactive thermal polymerizable compound is an aliphatic lactone.

~~20. The ink-jet print head according to claim 19, wherein said aliphatic lactone has the following general formula:~~



~~wherein n is an integer of from 1 to 10.~~

~~21. The ink-jet print head according to claim 20, wherein n is an integer of from 2 to 8.~~

~~22. The ink-jet print head according to claim 20, wherein said aliphatic lactone is selected from the group consisting of propiolactone, butyrolactone, valerolactone, and caprolactone.~~

11~~23~~. The ink-jet print head according to claim 9~~18~~, wherein said curable resin composition comprises less than 40, more preferably less than 30 weight percent of said thermal polymerizable compound based on the total weight of said curable resin composition.

~~24. The ink-jet print head according to claim 18, wherein said curable resin composition comprises at least 5, more preferably at least 10 weight percent of said thermal polymerizable compound based on the total weight of said curable resin composition.~~

~~25. The ink-jet print head according to claim 18, wherein said curable resin composition comprises from 1 to 25, preferably from 5 to 15 weight percent of a polylactone based on the total weight of said curable resin composition.~~

12~~26~~. The ink-jet print head according to claim ~~18~~9, wherein said curable resin composition comprises a thermal polymerization initiator.

~~27. The ink-jet print head according to claim 26, wherein said thermal polymerization initiator is a compound selected from the group consisting of aliphatic and aromatic amides, aliphatic and aromatic alcohols, aliphatic and aromatic diols, aliphatic and aromatic~~

~~polyols, and phenols.~~

13~~28~~. The ink-jet print head according to claim ~~26~~12, wherein said curable resin composition comprises from 1 to 20 weight percent of said thermal polymerization initiator based on the total weight of said curable resin composition

~~29. The ink-jet print head according to claim 26, wherein said curable resin composition comprises from 5 to 15 weight percent of said thermal polymerization initiator based on the total weight of said curable resin composition~~

14~~30~~. The ink-jet print head according to claim 1, wherein said curable resin composition comprises an adhesion promoter.

15~~31~~. The ink-jet print head according to claim 14~~30~~, wherein said adhesion promoter is a compound selected from the group consisting of a transition metal chelate, a mercaptan, a thiol-containing compound, a carboxylic acid, an organic phosphoric acid, a diol, an alkoxysilane, a combination of an alkoxysilane and a hydroxy-functional polyorganosiloxane, and a combination thereof.

~~32. The ink-jet print head according to claim 30, wherein said adhesion promoter is a epoxy-functional alkoxysilane selected from the group consisting of 3-glycidoxypropyltrimethoxysilane, 3-glycidoxypropyltriethoxysilane, (epoxycyclo hexyl) ethyldimethoxysilane, (epoxycyclohexyl)ethyldiethoxysilane and combinations thereof..~~

~~33. The ink-jet print head according to claim 30, wherein said adhesion promoter is a unsaturated alkoxysilane selected from the group consisting of vinyltrimethoxysilane, allyltrimethoxysilane, allyltriethoxysilane, hexenyl- trimethoxysilane, undecylenyltrimethoxysilane, 3-methacryloyloxypropyl trimethoxysilane, 3-methacryloyloxypropyl triethoxysilane, 3-acryloyloxypropyl trimethoxysilane, 3-acryloyloxypropyl~~

~~triethoxysilane, and combinations thereof.~~

16~~34~~. The ink-jet print head according to claim 14~~30~~, wherein said curable resin composition comprises from 1 to 20 weight percent of said adhesion promoter based on the total weight of said curable resin composition

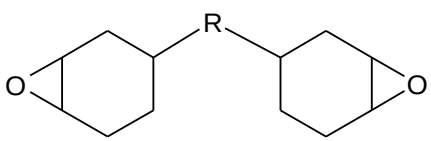
~~35. The ink-jet print head according to claim 30, wherein said curable resin composition comprises from 3 to 15 weight percent of said adhesion promoter based on the total weight of said curable resin composition.~~

~~36. The ink-jet print head according to claim 1, wherein said substrate is made of a material selected from the group consisting of glass, metal, plastic, ceramic, and silicon.~~

17~~37~~. A process for manufacturing an ink jet printhead comprising a polymeric material layer (5) defining ink passage ways and ejection chambers formed on a substrate, said process comprising the steps of: providing a substrate (1) comprising a plurality of ink ejection energy generating elements (2) on a surface thereof, applying a layer of curable resin composition on said surface of said substrate (1), defining ink passage ways and ejection chambers (4), and curing said layer of curable resin composition so as to form said polymeric material layer (5), characterized in that said curable resin composition comprises:

(a) a cyclic aromatic difunctional epoxy resin obtained by the condensation of bisphenol A and epichlorohydrine having a weight per epoxide (EEW) of at least 400 g/eq.,

(b) a cyclic aliphatic difunctional epoxy resin represented by the following general formula:



wherein R is a carboxyalkylene group of formula $-(CH_2)_p-COO-$ or $-(CH2)_q-$ $COO-(CH_2)_r-OOC-(CH_2)_s-$ and p, q, r, and s each independently is an integer of from 1 to 9, and

(c) a polymerization initiator.

18~~38~~. The process for manufacturing an ink jet printhead according to claim 17~~37~~, wherein said step of applying a layer of curable resin composition on said surface of said substrate (1) is made by spin coating or spray coating said curable resin composition on said substrate (1).

19~~39~~. The process for manufacturing an ink jet printhead according to claim 17~~37~~, wherein said curable resin composition comprises a non photoreactive thermal polymerizable compound.

20~~40~~. The process for manufacturing an ink jet printhead according to claim 17~~37~~, further comprising, before the step of curing said layer of curable resin composition, the step of subjecting said curable resin composition to a thermal treatment at a temperature in the range of from 150° to 220°C for a time period of from 10 minutes to 60 minutes.

21~~41~~. The process for manufacturing an ink jet printhead according to claim 17~~37~~, further comprising, before the step of curing said layer of curable resin composition, the step of subjecting said curable resin composition to a thermal treatment at a temperature in the range of from 180°C to 220 for a time period of from 30 minutes to 50 minutes.

22~~42~~. The process for manufacturing an ink jet printhead according to claim 17~~37~~, further comprising a step of forming an opening (3) for feeding ink through said substrate (1).

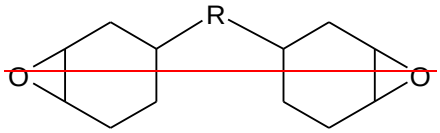
23~~43~~. The process for manufacturing an ink jet printhead according to claim 17~~37~~, wherein said step of defining ink passage ways and ejection chambers (4), is made by realizing a pattern (4a) made of a

removable material defining ink passage ways and ejection chambers on said surface of said substrate (1), before said step of applying a layer of curable resin composition, and removing said pattern (4a) made of a removable material, after said step of curing said layer of curable resin composition

~~44. A curable resin composition comprising~~

~~(a) a cyclic aromatic difunctional epoxy resin obtained by the condensation of bisphenol A and epichlorohydrine having a weight per epoxide (EEW) of at least 400 g/eq.,~~

~~(b) a cyclic aliphatic difunctional epoxy resin represented by the following general formula:~~



~~wherein R is a carboxyalkylene group of formula $-(CH_2)_p$-COO- or -(CH2)$_q$- COO-$(CH_2)_r$-OOC-$(CH_2)_s$- and p, q, r, and s each independently is an integer of from 1 to 9, and~~

~~(c) a polymerization initiator.~~

~~45. Use of the curable composition of claim 2444 to manufacture an ink jet printhead able to resist to chemically aggressive solvent-based inks.~~

24. The ink jet printhead according to claim 4, wherein said curable resin composition comprises from 10% to 30% by weight of said cyclic aromatic di-functional epoxy resin based on the total weight of said curable resin composition.

25. The ink jet printhead according to claim 24, wherein said curable resin composition comprises from 15% to 25% by weight of said cyclic aromatic di-functional epoxy resin based on the total weight of said curable resin composition.

26. The ink jet printhead according to claim 5, wherein said curable resin composition comprises from 20% to 40% by weight of said cyclic aliphatic di-functional epoxy resin based on the total weight of said curable resin composition.

27. The ink jet printhead according to claim 26, wherein said curable resin composition comprises from 25% to 35% by weight of said cyclic aliphatic di-functional epoxy resin based on the total weight of said curable resin composition.

28. The ink jet printhead according to claim 11, wherein said curable resin composition comprises from 10 to 30 weight percent of said non-photo-reactive thermal-polymerizable compound based on the total weight of said curable resin composition.

29. The ink jet printhead according to claim 28, wherein said curable resin composition comprises from 15 to 25 weight percent of said non-photo-reactive thermal-polymerizable compound based on the total weight of said curable resin composition.