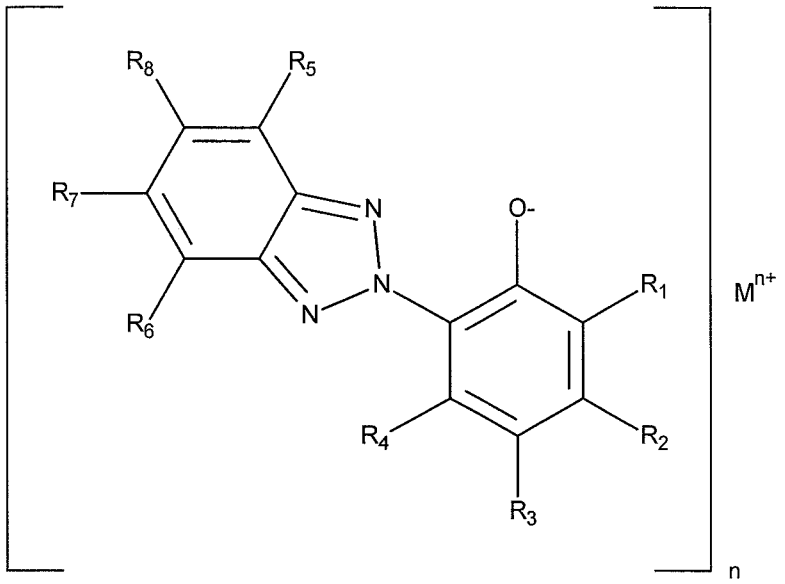
atom with a valency of n; and the macromolecular assembly comprises 2-4 repeat units. A wide variety of polymers that are free of ester linkages can be used in the polymeric compositions.

In one aspect, there is provided a polymeric composition comprising:

at least one polymer; and

an additive comprising at least one macromolecular salt composition, the macromolecular salt composition comprising an assembly of metal salts comprising repeat units of a substituted benzotriazole phenolate anion and a metal cation with the structure:



wherein R^1 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, a halogen atom, or a substituted heteroatom group comprising a $-SiR^{20}{}_3$, a $-CH_2-R^9$, an $-O-R^9$, a $-N-R^9R^{10}$, a $-S-R^9$, a $-S(O)-R^9$, or a $-S(O)_2-R^9$ group, where S(O) is a sulfinyl group S=O, and $S(O)_2$ is a sulfonyl group O=S=O, R^9 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, wherein the $-SiR^{20}{}_3$, $-CH_2-R^9$, $-O-R^9$, $-N-R^9R^{10}$, $-S-R^9$, $-S(O)-R^9$, or $-S(O)_2-R^9$ group may be neutral or anionic, and R^{10} comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, or R^9 and R^{10} together with the atoms connecting form a heterocyclic ring structure,

each R^{20} independently comprises an alkyl group;

each R^2, R^5, R^6 R^7 or R^8 independently comprises a hydrogen atom, an alkyl group, or a halogen atom;

R^3 comprises a hydrogen atom, an alkyl group, an aryl group, or a substituted heteroatom group comprising an -O-R^9 group, wherein R^9 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, wherein the -O-R^9 group is neutral or anionic;

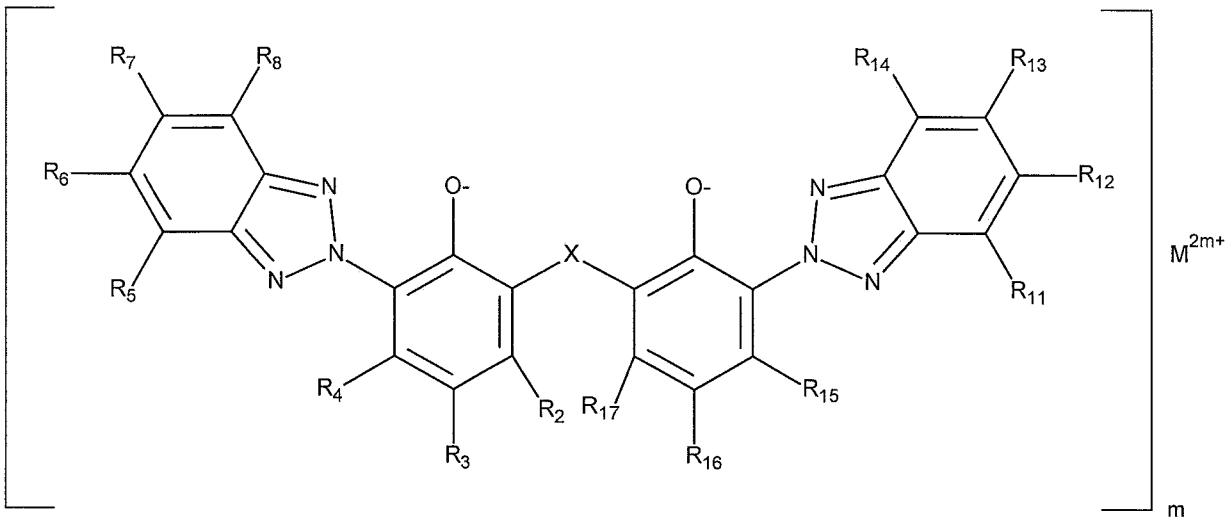
R^4 is a hydrogen atom;

n is an integer of 1 or 2;

and M comprises a metal atom with a valency of n;

and the macromolecular assembly comprises 2-4 repeat units.

In other embodiments of the polymer composition, the repeat unit of the macromolecular salt has the structure:

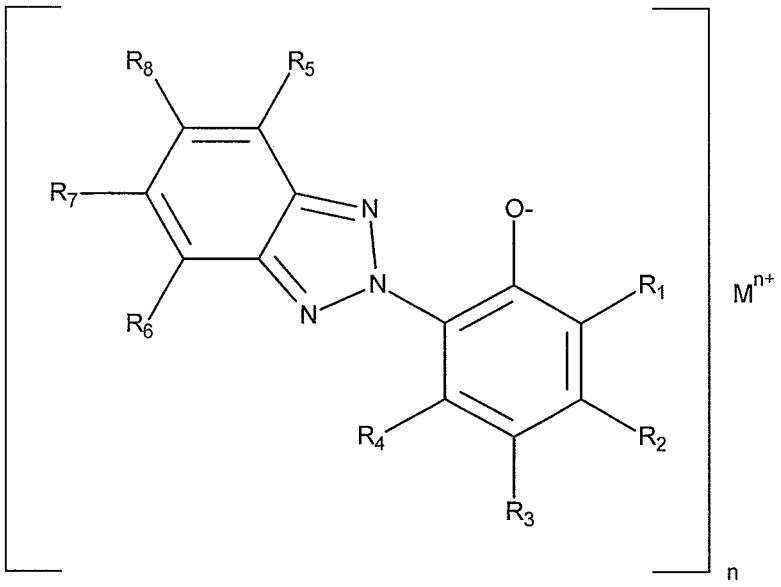


where X comprises a $-CH_2-$, -O-, -S-, -S(O)-, $-S(O)_2-$, or $-NR^{10}-$ linking group where R^{10} comprises a hydrogen atom, an alkyl group, or an aryl group, each R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^{11}, R^{12}, R^{13}, R^{14}, R^{15}, R^{16}, and R^{17}, independently comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a halogen atom; m = 0.5, 1, or 2; M is a metal ion with a valency of 2m such that M is lithium sodium or potassium when m = 0.5; M is calcium, magnesium, or cobalt, when m = 1; and M is vanadium or titanium when m = 2.

In another aspect, there is provided a method of preparing a polymer composition as defined herein comprising:

providing at least one polymer;

providing at least one macromolecular substituted benzotriazole phenolate salt comprising repeat units of a substituted benzotriazole phenolate anion and a metal cation with the structure:



wherein R^1 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, a halogen atom, or a substituted heteroatom group comprising a $-SiR^{20}_3$, a $-CH_2-R^9$, an $-O-R^9$, a $-N-R^9R^{10}$, a $-S-R^9$, a $-S(O)-R^9$, or a $-S(O)_2-R^9$ group, where S(O) is a sulfinyl group S=O, and $S(O)_2$ is a sulfonyl group O=S=O, R^9 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms,

wherein the $-SiR^{20}_3$, $-CH_2-R^9$, $-O-R^9$, $-N-R^9R^{10}$, $-S-R^9$, $-S(O)-R^9$, or $-S(O)_2-R^9$ group may be neutral or anionic, and R^{10} comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, or R^9 and R^{10} together with the atoms connecting form a heterocyclic ring structure, each R^{20} independently comprises an alkyl group;

each R^2, R^5, R^6 R^7 or R^8 independently comprises a hydrogen atom, an alkyl group, or a halogen atom;

R^3 comprises a hydrogen atom, an alkyl group, an aryl group, or a substituted heteroatom group comprising an $-O-R^9$ group, wherein R^9 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, wherein the $-O-R^9$ group is neutral or anionic;

R^4 is a hydrogen atom;

n is an integer of 1 or 2;

and M comprises a metal atom with a valency of n;

and the macromolecular assembly comprises 2-4 repeat units; and

mixing the polymer and at least one macromolecular substituted benzotriazole phenolate salt to form a polymer composition.

Brief Description of the Drawings

The present application may be more completely understood in consideration of the following detailed description of various embodiments of the disclosure in connection with the accompanying drawings.

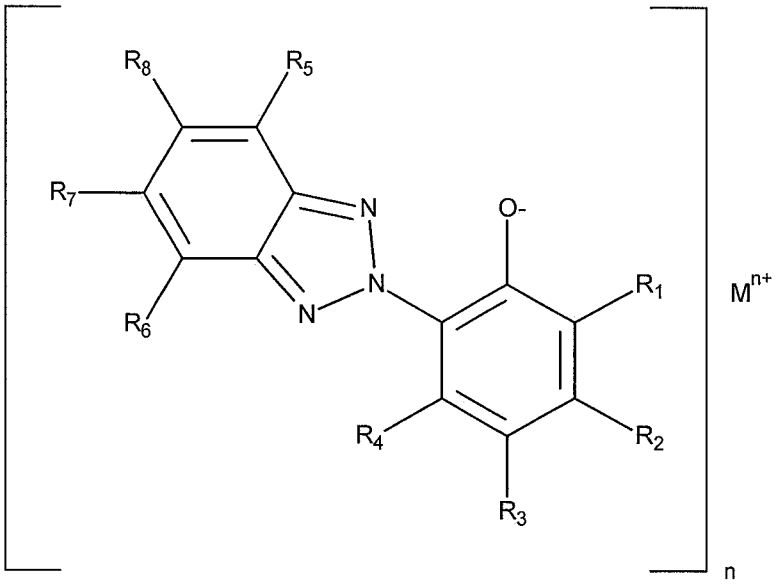
Figure 1 shows a view of NMR data for a precursor and for an embodiment of an article of this disclosure.

What is claimed is:

1. A polymeric composition comprising:

at least one polymer; and

an additive comprising at least one macromolecular salt composition, the macromolecular salt composition comprising an assembly of metal salts comprising repeat units of a substituted benzotriazole phenolate anion and a metal cation with the structure:



wherein R^1 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, a halogen atom, or a substituted heteroatom group comprising a $-SiR^{20}{}_3$, a $-CH_2-R^9$, an $-O-R^9$, a $-N-R^9R^{10}$, a $-S-R^9$, a $-S(O)-R^9$, or a $-S(O)_2-R^9$ group, where S(O) is a sulfinyl group S=O, and $S(O)_2$ is a sulfonyl group O=S=O, R^9 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, wherein the $-SiR^{20}{}_3$, $-CH_2-R^9$, $-O-R^9$, $-N-R^9R^{10}$, $-S-R^9$, $-S(O)-R^9$, or $-S(O)_2-R^9$ group may be neutral or anionic, and R^{10} comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, or R^9 and R^{10} together with the atoms connecting form a heterocyclic ring structure, each R^{20} independently comprises an alkyl group;

each R^2, R^5, R^6 R^7 or R^8 independently comprises a hydrogen atom, an alkyl group, or a halogen atom;

R^3 comprises a hydrogen atom, an alkyl group, an aryl group, or a substituted heteroatom group comprising an -O-R^9 group, wherein R^9 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, wherein the -O-R^9 group is neutral or anionic;

R^4 is a hydrogen atom;

n is an integer of 1 or 2;

and M comprises a metal atom with a valency of n;

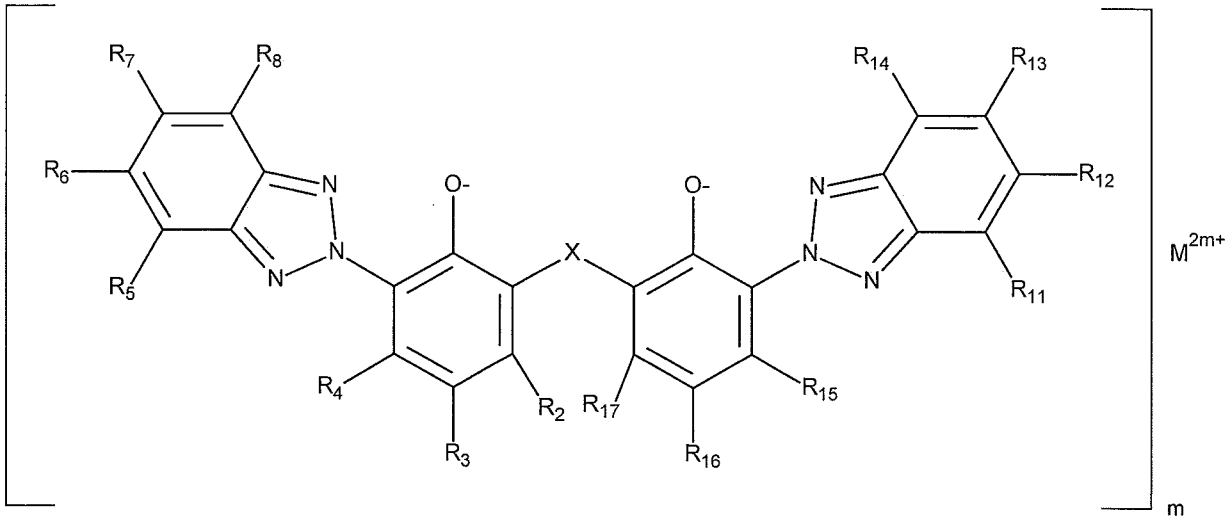
and the macromolecular assembly comprises 2-4 repeat units.

2. The polymer composition of claim 1, wherein the at least one polymer comprises an polymer that is essentially free of ester linkages, comprising an olefinic polymer or copolymer, a polyurethane, a polycarbonate, a polyamide, an aromatic polymer or copolymer, and combinations thereof.

3. The polymer composition of claim 2, wherein the at least one polymer comprises polyethylene, polypropylene, a copolymer of ethylene and propylene, a copolymer of ethylene or propylene with higher alpha-olefin monomers, a copolymer of ethylene or propylene with diene monomers, or combinations thereof.

4. The polymer composition of claim 1, wherein n = 1 and M comprises lithium, sodium, or potassium.

11. The polymer composition of claim 1, wherein the repeat unit of the macromolecular salt has the structure:



where X comprises a $-CH_2-$, -O-, -S-, -S(O)-, $-S(O)_2-$, or $-NR^{10}-$ linking group where R^{10} comprises a hydrogen atom, an alkyl group, or an aryl group,

each R^2, R^5, R^6, R^7, R^8, R^{11}, R^{12}, R^{13}, R^{14}, and R^{17}, independently comprises a hydrogen atom, an alkyl group, or a halogen atom;

each R^3 and R^{16} independently comprises a hydrogen atom, an alkyl group, or an aryl group; and

each R^4 and R^{15} comprises a hydrogen atom;

m = 0.5, or 1;

M is a metal ion with a valency of 2m such that M is lithium, sodium or potassium when m = 0.5; M is calcium, magnesium,or cobalt, when m = 1.

12. The polymer composition of claim 11, wherein X comprises a $-CH_2-$ linking group, and R^3 and R^{16} each comprises an alkyl group with 8 carbon atoms.

13. The polymer composition of claim 11, wherein X comprises a $-NR^{10}-$ linking group, where R^{10} comprises a hydrogen atom or a methyl group, and R^3 and R^{16} each comprises an alkyl group with 8 carbon atoms.

14. The polymer composition of claim 11, wherein X comprises an -S- linking group, and R^3 and R^{16} each comprises an alkyl group with 8 carbon atoms.

15. The polymer composition of claim 1, wherein the at least one macromolecular salts comprises a mixture of macromolecular salts.

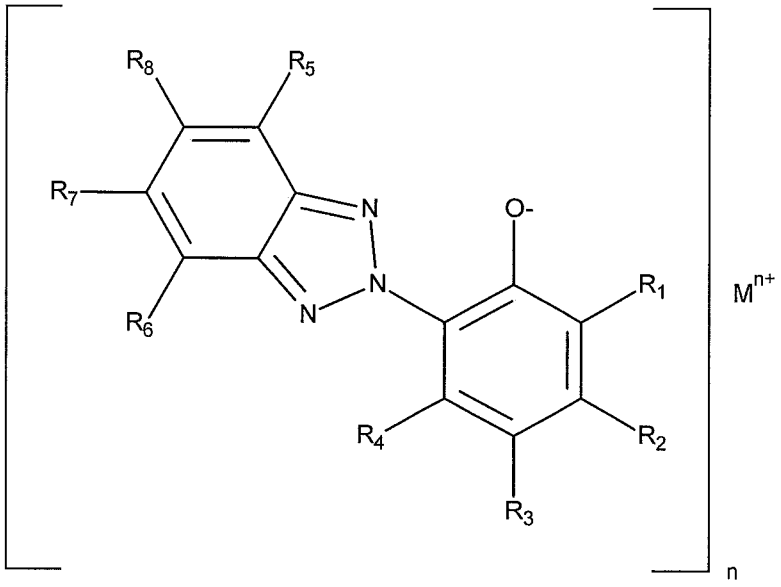
16. The polymer composition of claim 1, further comprising at least one additional additive.

17. The polymer composition of claim 16, the at least one additive comprising pigments, light stabilizers, primary and secondary antioxidants, metal deactivators, nucleators, hindered amines, hindered phenols, fatty acid metal salts, triester phosphites, phosphoric acid salts, fluorine-containing compounds and combinations thereof.

18. A method of preparing a polymer composition according to any one of claims 1 to 17 comprising:

providing at least one polymer;

providing at least one macromolecular substituted benzotriazole phenolate salt comprising repeat units of a substituted benzotriazole phenolate anion and a metal cation with the structure:



wherein R^1 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, a halogen atom, or a substituted heteroatom group comprising a $-SiR^{20}_3$, a $-CH_2-R^9$, an $-O-R^9$, a $-N-R^9R^{10}$, a $-S-R^9$, a $-S(O)-R^9$, or a $-S(O)_2-R^9$ group, where S(O) is a sulfinyl group S=O, and $S(O)_2$ is a sulfonyl group O=S=O, R^9 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms,

wherein the $-SiR^{20}{}_3$, $-CH_2-R^9$, $-O-R^9$, $-N-R^9R^{10}$, $-S-R^9$, $-S(O)-R^9$, or $-S(O)_2-R^9$ group may be neutral or anionic, and R^{10} comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, or R^9 and R^{10} together with the atoms connecting form a heterocyclic ring structure, each R^{20} independently comprises an alkyl group;

each R^2, R^5, R^6 R^7 or R^8 independently comprises a hydrogen atom, an alkyl group, or a halogen atom;

R^3 comprises a hydrogen atom, an alkyl group, an aryl group, or a substituted heteroatom group comprising an $-O-R^9$ group, wherein R^9 comprises a hydrogen atom, an alkyl group, an alkenyl group, an aryl group, or a heteroatom-containing group comprising one or more oxygen, nitrogen, or sulfur atoms, wherein the $-O-R^9$ group is neutral or anionic;

R^4 is a hydrogen atom;

n is an integer of 1 or 2;

and M comprises a metal atom with a valency of n;

and the macromolecular assembly comprises 2-4 repeat units; and

mixing the polymer and at least one macromolecular substituted benzotriazole phenolate salt to form a polymer composition.