BRIEF SUMMARY ~~OF THE INVENTION~~

[0018] Included in the ~~invention~~present disclosure herein is a curable fluorine-containing elastomer composition comprising a first curable perfluoropolymer comprising tetrafluoroethylene, a first perfluoroalkylvinyl ether and at least one first cure site monomer having at least one cure site, wherein tetrafluoroethylene is present in the first curable perfluoropolymer in an amount of at least about 50 mole percent; a second curable perfluoropolymer comprising tetrafluoroethylene, a second perfluoroalkylvinyl ether and at least one second cure site monomer having at least one cure site, wherein the second curable perfluoropolymer comprises fluoroplastic particles therein; and at least one curative. Preferably, the first curable perfluoropolymer comprises at least about 60 mole percent tetrafluoroethylene, more preferably at least about 70 mole percent tetrafluoroethylene. In addition, the first perfluoropolymer may comprise about 60 to about 95 mole percent tetrafluoroethylene.

[0018a] In a first aspect of the present disclosure, there is provided a curable fluorine-containing elastomer composition formed by combining

a first unfilled curable perfluoropolymer comprising tetrafluoroethylene, a first perfluoroalkylvinyl ether and at least one first cure site monomer having at least one cure site, wherein tetrafluoroethylene is present in the first curable perfluoropolymer in an amount of at least about 50 mole percent;

a second curable perfluoropolymer comprising tetrafluoroethylene, a second perfluoroalkylvinyl ether and at least one second cure site monomer having at least one cure site, wherein the second curable perfluoropolymer comprises fluoroplastic particles in a matrix of the second curable perfluoropolymer, wherein such fluoroplastic has a functional curesite and is incorporated into the second curable perfluoropolymer matrix; and

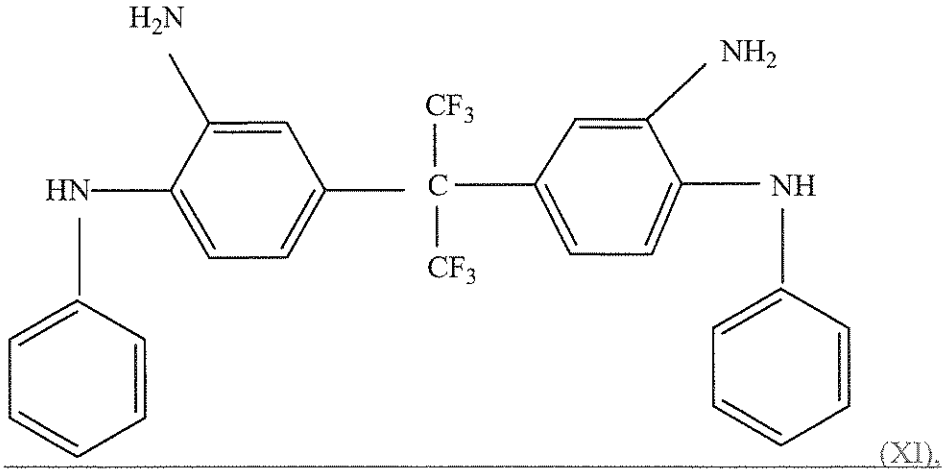
at least one curative.

[0018b] In a second aspect of the present disclosure, there is provided a curable perfluoroelastomer composition formed by combining

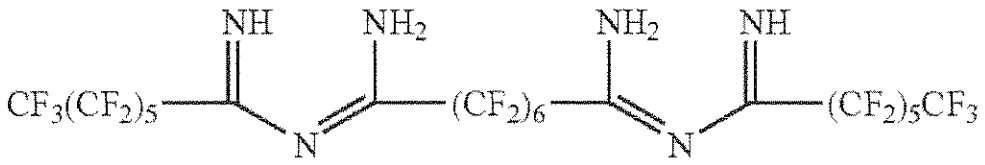
a first curable perfluoropolymer comprising tetrafluoroethylene, a first perfluoroalkylvinyl ether and at least one first cure site monomer having at least one cure site, wherein the tetrafluoroethylene is present in the first curable perfluoropolymer in an amount of at least about 50 mole percent;

a second curable perfluoropolymer comprising tetrafluoroethylene, a second perfluoroalkylvinyl ether and at least one second cure site monomer having at least one cure site, wherein the second curable perfluoropolymer comprises fluoroplastic particles in a matrix of the second curable perfluoropolymer, wherein such fluoroplastic has a functional curesite and is incorporated into the second curable perfluoropolymer matrix; and

at least one curative the at least one curative is selected from the group consisting of:



(XI),



(XII),

bisaminophenol, bisaminophenol AF, and combinations thereof, wherein at least one of the cure site monomer in the first curable perfluoropolymer and the cure site monomer in the second curable perfluoropolymer is CF_2=$CFO(CF_2)_5CN$, and wherein the second curable perfluoropolymer comprises fluoroplastic particles in the second curable perfluoropolymer matrix as a result of blending during latex polymerization, and wherein the functional cure site of the fluoroplastic particles is a cyano group and the second perfluoropolymer comprises a nitrogen-containing cure site monomer.

[0018c] In a third aspect of the present disclosure, there is provided a cured fluorine-containing elastomer formed by curing a curable fluorine-containing composition which is formed by combining

a first curable perfluoropolymer comprising tetrafluoroethylene, a first perfluoroalkylvinyl ether and at least one first cure site monomer having at least one cure site, wherein tetrafluoroethylene is present in the first curable perfluoropolymer in an amount of at least about 50 mole percent;

a second curable perfluoropolymer comprising tetrafluoroethylene, a second perfluoroalkylvinyl ether and at least one second cure site monomer having at least one cure site, wherein the second curable perfluoropolymer comprises fluoroplastic particles in a matrix of the second curable perfluoropolymer, wherein such fluoroplastic has a functional curesite and is incorporated into the second curable perfluoropolymer matrix; and

at least one curative, wherein the fluoroplastic having the curesite and incorporated into the second curable perfluoropolymer matrix remains in the matrix of the cured perfluoroelastomer after combining and curing the first and the second curable perfluoropolymers.

[0018d] In a fourth aspect of the present disclosure, there is provided a molded article formed by heat curing and shaping a composition formed by combining

a first curable perfluoropolymer comprising tetrafluoroethylene, a first perfluoroalkylvinyl ether and at least one first cure site monomer having at least one cure site, wherein tetrafluoroethylene is present in the first curable perfluoropolymer in an amount of at least about 50 mole percent;

a second curable perfluoropolymer comprising tetrafluoroethylene, a second perfluoroalkylvinyl ether and at least one second cure site monomer having at least one cure site, wherein the second curable perfluoropolymer comprises fluoroplastic particles in a matrix of the second curable perfluoropolymer, wherein such fluoroplastic has a functional curesite and is incorporated into the second curable perfluoropolymer matrix; and

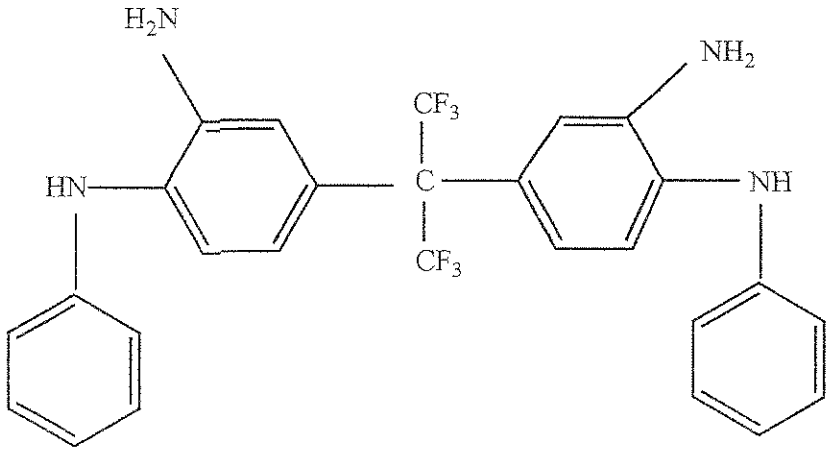
at least one curative.

[0019] Such compositions are preferably blends having the first curable perfluoropolymer and the second curable perfluoropolymer in a ratio of about 25 to about 75 mole percent to about 75 to about 25 mole percent, preferably about 40 to about 60 mole percent to about 60 to about 40 mole percent, and most preferably about 50 to about 50.

[0020] Each of the at least one cure site monomers is preferably present in an amount of about 0.01 to about 10 mole percent respectively in each of the first curable perfluoropolymer and the second curable perfluoropolymer. The at least one curative is preferably present in an amount of about 0.01 to about 5 parts by weight per 100 parts by weight of the perfluoropolymers in the composition, and more preferably about 0.01 to about 2 parts by weight per 100 parts by weight of the perfluoropolymers in the composition.

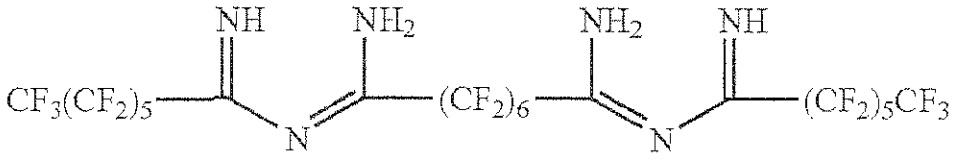
[0021] The at least one cure site in the at least one cure site monomer in the first curable perfluoropolymer is preferably a nitrogen-containing cure site. The at least one cure site in the at least one cure site monomer in the first curable perfluoropolymer may be selected from the group consisting of cyano, carboxyl, carbonyl, alkoxycarbonyl, and combinations thereof.

[0022] The fluoroplastic particles are preferably present in the second curable fluoropolymer as a result of either melt-blending or blending during latex polymerization, and most preferably as a result of blending during latex polymerization. It is further preferred that the fluoroplastic particles comprise a nitrogen-containing cure site monomer, wherein the second curable fluoropolymer comprises a cure site monomer having a cure site selected from the group consisting of halogen, nitrogen-containing groups, carboxyl, alkoxycarbonyl and



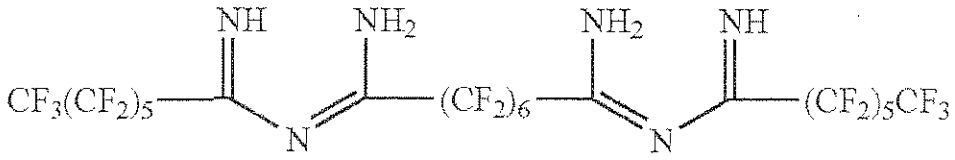
(XI).

[0027] In such an embodiment, the at least one curative may further comprise bisaminophenol or bisaminophenol AF. In addition or as an alternative thereto, the at least one curative may further comprise



(XII).

[0028] In another embodiment of the curable fluorine containing elastomer composition herein, the elastomer composition is a perfluoroelastomer composition and the at least one curative comprises

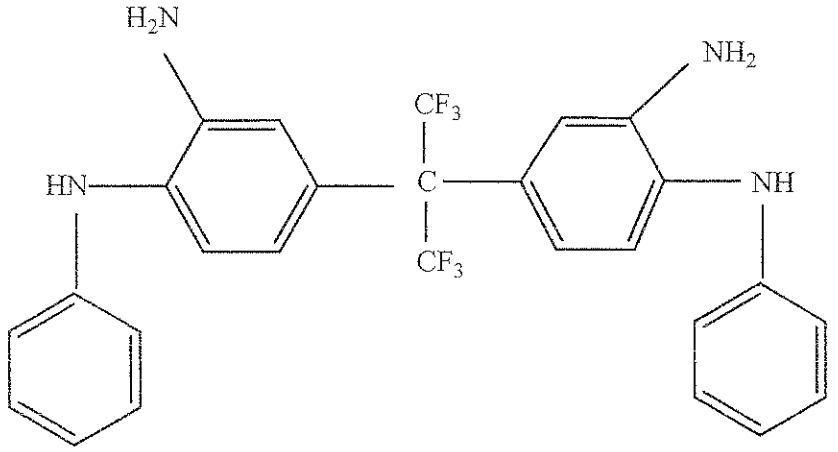


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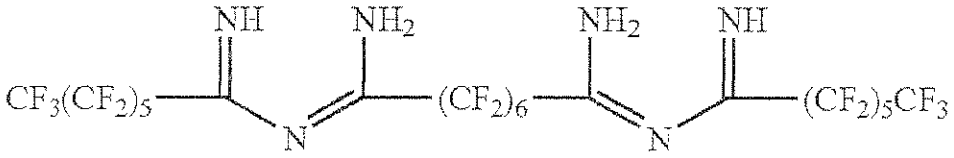
[0029] It is further preferred that in one embodiment hereof, the cure site monomer in the first curable fluoropolymer and/or the second curable fluoropolymer is $CF_2=CFO(CF_2)_5CN$.

The ~~invention~~present disclosure also includes a curable perfluoroelastomer composition comprising a first curable perfluoropolymer comprising tetrafluoroethylene, a first perfluoroalkylvinyl ether and at least one first cure site monomer having at least one cure site, wherein the tetrafluoroethylene is present in the first curable perfluoropolymer in an amount of at least about 50 mole percent; a second curable perfluoropolymer comprising tetrafluoroethylene, a second perfluoroalkylvinyl ether and at least one second cure site monomer having at least one cure site, wherein the second curable perfluoropolymer comprises fluoroplastic particles therein; and at least one

curative the at least one curative is selected from the group consisting of: at least one curative the at least one curative is selected from the group consisting of:



(XI),



(XII),

bisaminophenol, bisaminophenol AF, and combinations thereof, wherein at least one of the cure site monomer in the first curable perfluoropolymer and the cure site monomer in the second curable perfluoropolymer is CF_2=CFO(CF_2)$_5$CN, and wherein the second curable fluoropolymer comprises fluoroplastic particles as a result of blending during latex polymerization, the fluoroplastic particles comprising a nitrogen-containing cure site monomer.

[0030] In this embodiment, tetrafluoroethylene is preferably present in the first curable perfluoropolymer in an amount of at least about 60 mole percent, and more preferably at least about 70 mole percent. The tetrafluoroethylene may also be present in the first curable perfluoropolymer in an amount of about 60 mole percent to about 95 mole percent.

[0031] The ~~invention~~present disclosure also includes a cured fluorine-containing elastomer formed by curing a curable fluorine-containing composition comprising a blend of a first curable perfluoropolymer comprising tetrafluoroethylene, a first perfluoroalkylvinyl ether and at least one first cure site monomer having at least one cure site, wherein tetrafluoroethylene is present in the first curable perfluoropolymer in an amount of at least about 50 mole percent; a second curable perfluoropolymer comprising tetrafluoroethylene, a second perfluoroalkylvinyl ether

and at least one second cure site monomer having at least one cure site, wherein the second curable perfluoropolymer comprises fluoroplastic particles therein; and at least one curative.

[0032] Molded articles are also within the scope of the ~~invention~~present disclosure which are formed by heat curing and shaping a composition comprising a blend of a first curable perfluoropolymer comprising tetrafluoroethylene, a first perfluoroalkylvinyl ether and at least one first cure site monomer having at least one cure site, wherein tetrafluoroethylene is present in the first curable perfluoropolymer in an amount of at least about 50 mole percent; a second curable perfluoropolymer comprising tetrafluoroethylene, a second perfluoroalkylvinyl ether and at least one second cure site monomer having at least one cure site, wherein the second curable perfluoropolymer comprises fluoroplastic particles therein; and at least one curative.

DETAILED DESCRIPTION OF THE INVENTION

[0033] Compositions are provided herein which have good plasma and chemical resistance and which can be made without additional filler loading, but which also provide required mechanical properties and excellent heat resistance. The combination of properties achieved can be obtained by selectively blending two or more curable perfluoropolymers in a composition with at least one curative as described herein. The resulting materials can be heat-cured and processed into molded articles. The curable fluorine-containing elastomer compositions herein have two or more such curable perfluoropolymers.

[0034] It is preferred herein that the two or more perfluoropolymers in the composition are used in and/or cured to form a perfluoroelastomeric blended composition, however, such polymers may be used in combination with other non-perfluorinated curable fluoropolymers forming a fluorinated elastomer having these components therein upon cure.

[0035] As used in this application, "perfluoroelastomer" or "cured perfluoroelastomer" unless otherwise indicated, includes any cured elastomeric material or composition that is formed by curing a curable perfluoropolymer(s) such as the curable perfluoropolymers in the curable perfluoroelastomeric compositions described herein.

[0036] A "curable perfluoropolymer" (sometimes referred to in the art as a "perfluoroelastomer" or more appropriately a "perfluoroelastomer gum") that may be used to form a cured perfluoroelastomer is a polymer that is substantially completely fluorinated, which is preferably completely perfluorinated on its polymeric backbone. It will be understood, based on this disclosure, that some residual hydrogen may be present in some perfluoroelastomers within the crosslinks of those materials due to use of hydrogen as part of a functional