CLAIMS

We claim:

1. A curable fluorine-containing elastomer composition comprising

at least one curable fluoropolymer selected from (i) curable fluoropolymers comprising at least two fluorinated monomers, one of which is a fluorinated olefin or a fluorinated alkyl vinyl ether, and the other of which is vinylidene fluoride or at least one fluorine-containing cure site monomer comprising at least one cure site and (ii) a curable perfluoropolymer that comprises one or more perfluorinated olefin or perfluorinated alkyl vinyl ether monomers and at least one perfluorinated fluorine-containing cure site monomer comprising at least one cure site; and

microdiamond particles having an average particle size of greater than 0.10 micron to 100 microns, wherein upon curing the composition, the resulting fluoroelastomer or perfluoroelastomer has a reduced particulation, and increased plasma resistance.

2. The curable fluorine-containing elastomer composition according to claim 1, wherein the microdiamond particles have an average particle size of greater than 0.1 micron to 10 microns.

3. The curable fluorine-containing elastomer composition according to claim 2, wherein the microdiamond particles have an average particle size of about greater than 0.1 micron to 5 microns.

4. The curable fluorine-containing elastomer composition according to claim 2, wherein the microdiamond particles have an average particle size of 0.20 micron to 2 microns.

5. The curable fluorine-containing elastomer composition according to claim 4, wherein the microdiamond particles have an average particle size of 0.25 micron to 1 micron.

6. The curable fluorine-containing elastomer composition according to claim 1, wherein the microdiamond particles have an average particle size of 0.25 micron to 0.5 micron.

7. The curable fluorine-containing elastomer composition according to claim 1, wherein the microdiamond particles have a shape selected from spherical particles, fibers or flasks.

8. The curable fluorine-containing elastomer composition according to claim 1, wherein the microdiamond particles are natural microdiamond particles.

9. The curable fluorine-containing elastomer composition according to claim 1, wherein the microdiamond particles are synthetic microdiamond particles.

10. The curable fluorine-containing elastomer composition according to claim 1, wherein the microdiamond particles are a blend of natural microdiamond particles and synthetic microdiamond particles.

11. The curable fluorine-containing elastomer composition according to claim 1, wherein the particles are present in an agglomerated or aggregate form.

12. The curable fluorine-containing elastomer composition according to claim 1, wherein the composition comprises 0.1 to 100 parts of microdiamond particles per 100 parts by weight of the at least one curable fluoropolymer.

13. The curable fluorine-containing elastomer composition according to claim 12, wherein the composition comprises 1 to 50 parts of microdiamond particles per 100 parts by weight of the at least one curable fluoropolymer.

14. The curable fluorine-containing elastomer composition according to claim 13, wherein the composition comprises 2 to 20 parts by weight of microdiamond particles per 100 parts by weight of the at least one curable fluoropolymer.

15. The curable fluorine-containing elastomer composition according to claim 1, wherein the at least one curable fluoropolymer is a curable perfluoropolymer comprising tetrafluoroethylene and perfluoroalkyl vinyl ether and at least one perfluorinated cure site monomer.

16. The curable fluorine-containing elastomer composition according to claim 15, further comprising at least one curative.

17. The curable fluorine-containing elastomer composition according to claim 16, wherein the curative is a peroxide cure system.

18. The curable fluorine-containing elastomer composition according to claim 1, wherein the at least one curable fluoropolymer is a curable perfluoropolymer comprising tetrafluoroethylene, a perfluoroalkylvinyl ether monomer, and wherein the curable perfluoropolymer comprises fluoroplastic particles therein.

19. The curable fluorine-containing elastomer composition according to claim 18, further comprising at least one curative.

20. The curable fluorine-containing elastomer composition according to claim 19, wherein the curative is a peroxide cure system.

21. The curable fluorine-containing elastomer composition according to claim 1, wherein the curable fluoropolymer is a perfluoropolymer comprising tetrafluoroethylene and a

perfluoroalkylvinyl ether monomer, and there are at least two of the fluorine-containing perfluorinated cure site monomers, each having at least one cure site.

22. The curable fluorine-containing elastomer composition according to claim 21, further comprising at least one curative.

23. The curable fluorine-containing elastomer composition according to claim 22, wherein one of the curatives is a peroxide cure system.

24. The curable fluorine-containing elastomer composition according to claim 22, wherein the composition comprises a blend of the curable perfluoropolymer with a second curable perfluoropolymer comprising tetrafluoroethylene, a second perfluoroalkylvinyl ether monomer and a perfluorinated cure site monomer, and wherein the second perfluoropolymer comprises fluoroplastic particles therein, and the composition further comprises at least two curatives.

25. The curable fluorine-containing elastomer composition according to claim 24, wherein a range of a ratio of a weight percent of first curable perfluoropolymer to a weight of the second curable perfluoropolymer is 5:95 to 95:5.

26. The curable fluorine-containing elastomer composition according to claim 25, wherein the range of the ratio of the weight percent of the first curable perfluoropolymer to the second curable perfluoropolymer is 20:80 to 80:20.

27. The curable fluorine-containing elastomer composition according to claim 26, wherein the range of the ratio of the weight percent of the first curable perfluoropolymer to the second curable perfluoropolymer is 40:60 to 60:40.

28. The curable fluorine-containing elastomer composition according to claim 27, wherein the ratio of the weight percent of the first curable perfluoropolymer to the second curable perfluoropolymer is about 50:50.

29. The curable fluorine-containing elastomer composition according to claim 24, wherein each of the at least two cure site monomers of the first curable perfluoropolymer is present in an amount of 0.1 to 10 mole percent in the first curable perfluoropolymer and the at least one cure site monomer of the second curable perfluoropolymer, is present in an amount of 0.1 to 10 mole percent in the second curable perfluoropolymer.

30. The curable fluorine-containing elastomer composition according to claim 24, wherein the cure sites in at least two cure site monomers in the first curable perfluoropolymer are nitrogen-containing cure sites.

31. The curable fluorine-containing elastomer composition according to claim 30, wherein the first curable perfluoropolymer comprises a first cure site monomer comprising a primary cyano cure site and a second cure site monomer comprising a secondary cyano cure site.

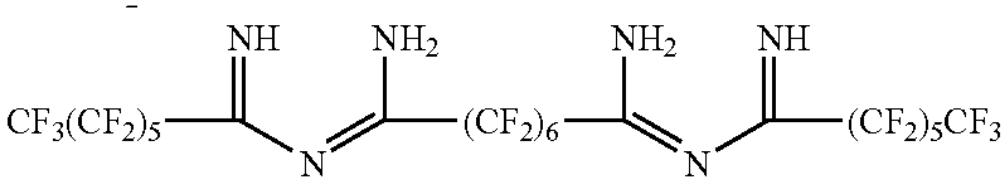
32. The curable fluorine-containing elastomer composition according to claim 24, wherein the at least one cure site in each of the at least two cure site monomers in the first curable perfluoropolymer is selected from the group consisting of cyano, carboxyl, carbonyl, alkoxycarbonyl, and combinations thereof.

33. The curable fluorine-containing elastomer composition according to claim 24, wherein the at least two curatives are present in the composition in a total amount of 0.2 to 10 parts by weight per 100 parts by weight of the curable perfluoropolymers in the composition.

34. The curable fluorine-containing elastomer composition according to claim 24, wherein each of the at least two curatives is present in the composition in an amount of 0.1 part to 6 parts by weight per 100 parts by weight of the curable perfluoropolymers.

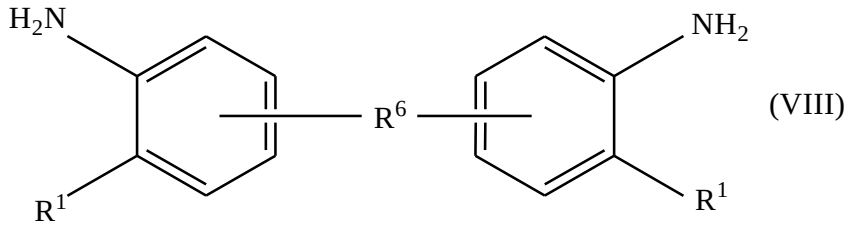
35. The curable fluorine-containing elastomer composition according to claim 24, wherein the at least two curatives comprises a first curative that is present in the composition in an amount of 0.5 part to 4 parts by weight per 100 parts by weight of the curable perfluoropolymers, and a second curative that is present in the composition in an amount of 0.3 part to 2 parts by weight per 100 parts by weight of the curable perfluoropolymers.

36. The curable fluorine containing elastomer composition according to claim 24, wherein the first curative is



(XII)

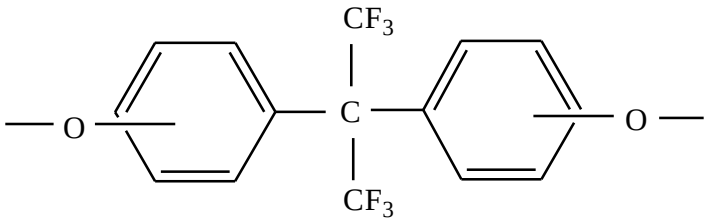
and the second curative is



(VIII)

wherein each R^1 is independently $-NH_2$, $-NHR_2$, -OH or -SH; R^2 is a monovalent organic group; and wherein R^6 is $-SO_2$, -O-, -CO-, an alkylene group of 1 to 6 carbon atoms, a

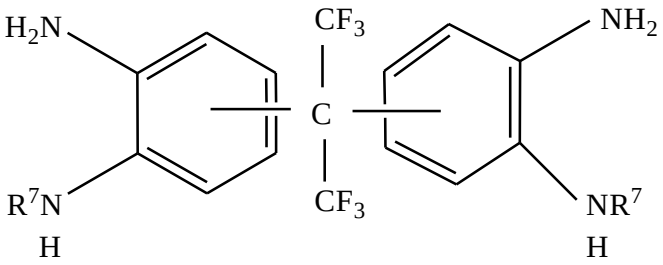
perfluoroalkylene group of 1 to 10 carbon atoms, a single bond or a group as shown in Formula (IX):



(IX)

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37. The curable fluorine-containing elastomer composition according to claim 36, wherein the second curative is a compound according to formula (X):



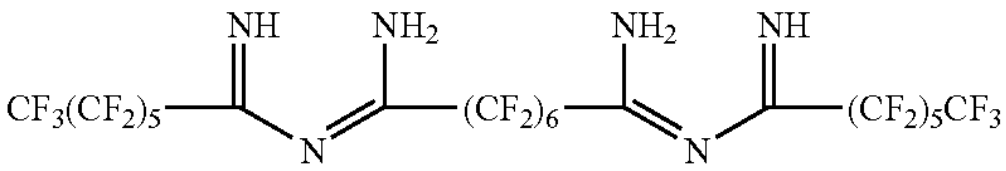
(X)

wherein R^7 is independently selected from hydrogen, an alkyl group of 1 to 10 carbon atoms; a partially fluorinated or perfluorinated alkyl group of 1 to 10 carbon atoms; a phenyl group; a benzyl group; or a fluorinated or partially fluorinated phenyl group; a fluorinated or partially fluorinated benzyl group; or a phenyl or an alkyl group having a function group or groups that is a lower alkyl or perfluoroalkyl group.

38. The curable fluorine-containing elastomer composition according to claim 36, wherein the second curative is a bisaminophenol or a salt thereof.

39. The curable fluorine-containing elastomer composition according to claim 24, wherein the second curable perfluoropolymer comprises a cure site monomer having a cure site selected from the group consisting of halogen, nitrogen-containing groups, carboxyl, alkoxycarbonyl and combinations thereof.

40. The curable fluorine-containing elastomer composition according to claim 24, wherein the at least two curatives are selected from the group consisting of:



(XII),

bisaminophenol and combinations thereof.

41. The curative fluorine-containing elastomer composition according to claim 40, wherein the first curative is a compound according to formula (XII) and the second curative is bisaminophenol.

42. The curable fluorine-containing elastomer composition according to claim 1, comprising a second curable fluoropolymer comprising tetrafluoroethylene and at least one second fluorine-containing monomer, one of which is a cure site monomer comprising at least one second cure site.

43. The composition according to claim 42, wherein the first curable fluoropolymer and/or the second curable fluoropolymer is a perfluoropolymer, and wherein the first curable fluoropolymer and the second curable fluoropolymer are different.

44. A cured fluorine-containing elastomer formed by curing the curable fluorine-containing composition of claim 1.

45. A molded article formed by heat curing and shaping a composition according to claim 1.

46. A method for forming a fluoroelastomeric article with reduced particulation, comprising:

preparing a curable fluorine-containing elastomer composition comprising at least one curable fluoropolymer selected from (i) curable fluoropolymers comprising at least two fluorinated monomers, one of which is a fluorinated olefin or a fluorinated alkyl vinyl ether, and the other of which is vinylidene fluoride or at least one fluorine-containing cure site monomer comprising at least one cure site, and (ii) a curable perfluoropolymer that comprises one or more perfluorinated olefin or perfluorinated alkyl vinyl ether monomers and at least one perfluorinated fluorine-containing cure site monomer comprising at least one cure site;

adding into the curable fluorine-containing elastomer composition microdiamond particles having an average particle size of greater than 0.10 microns to 100 microns; and

curing the curable fluorine-containing elastomer composition to form the fluoroelastomeric article, wherein the fluoroelastomeric article has reduced particulation in comparison to a second fluoroelastomeric article having the same fluorine-containing elastomer composition but that does not include the microdiamond particles, when the fluoroelastomeric article and the second fluoroelastomeric article are exposed to at least one of a fluorine-based plasma, an oxygen-based plasma, a hydrogen-based plasma, and combinations thereof.

47. The method according to claim 46, wherein the curable fluorine-containing elastomer composition includes at least one filler and the method further comprises adding the microdiamond particles into the fluorine-containing elastomer composition while adding the at least one filler to the at least one first curable fluoropolymer.

48. The method according to claim 46, further comprising adding at least one curative prior to curing the curable fluorine-containing elastomer composition to form the fluoroelastomeric article.

49. The method according to claim 46, wherein the at least one curable fluoropolymer is a perfluoropolymer, comprising tetrafluoroethylene, the at least one fluorine-containing cure site monomer is a perfluorinated cure site monomer and the perfluoropolymer further comprises a perfluoroalkyl vinyl ether.

50. The method according to claim 46, wherein a compression set value of the fluoroelastomeric article at 250°C/70 hours/25% deflection is reduced in comparison to the second fluoroelastomeric article.

51. The method according to claim 50, wherein the curable fluorine-containing elastomer composition used to form the second fluoroelastomeric article further comprises a carbon black filler.

52. The method according to claim 46, wherein the fluoroelastomeric article has a reduced sticking force in comparison to the second fluoroelastomeric article.

53. The method according to claim 46, wherein the fluoroelastomeric article has improved resistance to a fluorine-based plasma, an oxygen-based plasma, a hydrogen-based plasma, and combinations thereof in comparison to the second fluoroelastomeric article.

54. The method according to claim 46, wherein the fluoroelastomeric article has improved physical properties in comparison to the second fluoroelastomeric article.

55. The method according to claim 46, wherein a compression set value of the fluoroelastomeric article at 350°C/70 hours/18% deflection is reduced in comparison to the second fluoroelastomeric article.

56. The method according to claim 55, wherein the curable fluorine-containing elastomer composition used to form the second fluoroelastomeric article further comprises a carbon black filler.