CLAIMS

We claim:

~~1. A composition for forming an article, comprising~~

~~2. at least one matrix polymer selected from the group consisting of at least one thermoplastic polymer and at least one curable polymer having at least one functional group for crosslinking; and~~

~~3. a three-dimensional, branched and/or crosslinked carbon nanostructure additive provided in an amount such that after forming an article the composition, the article is conductive and has a volume resistivity level of about 0.5 ohm-cm or less.~~

~~4. The composition according to claim 1, wherein when formed into an article, the article is an electromagnetic interference shielding article and/or a radiofrequency interference shielding article.~~

~~5. The composition according to claim 1, wherein the at least one matrix polymer is at least one curable polymer selected from the group consisting of a curable polymer comprising at least one silicon-containing monomer, a curable polymer comprising at least one monomer containing silicon and fluorine, a curable copolymer comprising at least one acrylonitrile monomer and at least one butadiene monomer, a curable polymer comprising at least one olefinic monomer, a curable polymer comprising at least one fluorinated monomer, a curable polymer comprising at least one perfluorinated monomer, and blends and copolymers thereof.~~

~~6. The composition according to claim 3, wherein upon cure, the cured polymer composition comprises one or more elastomers selected from the group consisting of a silicone, a fluorosilicone, a fluoroelastomer, a perfluoropolyether, a perfluoroelastomer, and cured elastomers formed from blends and copolymers thereof.~~

~~7. The composition according to claim 3, wherein the at least one curable polymer is selected from the group consisting of a curable fluorinated polymer, and a curable perfluorinated polymer.~~

~~8. The composition according to claim 5, wherein the at least one curable polymer is at least one curable perfluorinated polymer.~~

~~9. The composition according to claim 5, wherein the at least one curable polymer is a blend of or a copolymer of at least one curable fluoropolymer and at least one curable perfluoropolymer.~~

~~10. The composition according to claim 1, wherein the matrix polymer is at least one curable polymer having at least one functional group for crosslinking and the composition further comprises at least one crosslinking additive for reacting with the at least one functional group for crosslinking.~~

~~11. The composition according to claim 8, wherein upon curing the curable polymer composition, the resulting cured material is used in an electromagnetic interference shielding application or a radio frequency interference shielding application.~~

~~12. The composition according to claim 1, wherein the carbon nanostructure additive has a carbon content of greater than or equal to about 97% and a bulk density of about 0.135 g/cm^3.~~

~~13. The composition according to claim 1, further comprising at least one filler different from the at least one nanostructure additive.~~

~~14. The composition according to claim 1, comprising about 0.1 part by weight to about 300 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.~~

~~15. The composition according to claim 12, comprising about 0.25 to about 250 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.~~

~~16. The composition according to claim 13, comprising about 0.5 to about 250 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.~~

~~17. The composition according to claim 14, comprising about 0.5 to about 80 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.~~

~~18. The composition according to claim 1, wherein the at least one matrix polymer is selected from the group consisting of at least one curable fluoropolymer, at least one curable perfluoropolyether, and at least one curable perfluoropolymer, and the composition comprises about 10 to about 80 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.~~

~~19. The composition according to claim 16, wherein the composition comprises about 10 parts to about 50 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.~~

20. The composition according to claim 17, wherein the composition comprises about 20 parts to about 40 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

21. The composition according to claim 1, wherein the matrix polymer is a thermoplastic polymer selected from the group consisting of polyarylene-based polymers, thermoplastic melt-processible fluoropolymers, polyvinyl chloride, polyvinylidene fluoride, polytetrafluoroethylene, chlorinated fluoropolymers, silicon-based polymers, and non-curable fluoropolymers and perfluoropolymers, polyolefins, polyethylene terephthalates, polysiloxanes, polyurethanes, polyaramid, polyamides, polyimides, polyetherimides, polyphenylene sulfides, polyphenylene sulfones, polyether sulfones, polyamideimides, polybenizmidizoles, polycarbonates, polyacrylonitrile-butadiene-styrenes, polybutadiene-styrenes, polyepoxides, and similar materials, as well as blends, copolymers, alloys, and other combinations thereof.

22. The composition according to claim 1, further comprising one or more conductive filler different from the carbon nanostructure additive that are powders, flakes or fiber fillers comprising one or more of carbon; metal-plated glass; metal-plated particles wherein the particles comprise a metal or a polymer; nickel-coated graphite; graphene; graphite; carbon black; graphene derivatives; single-wall carbon nanotubes; multi-wall carbon nanotubes; gold; silver; nickel; copper; and combinations or mixtures thereof.

23. The composition according to claim 20, wherein the composition comprises about 0.25 parts by weight to about 100 parts by weight of the one more conductive filler different from the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

24. An elastomeric article and/or a thermoplastic article formed from the composition according to claim 1.

25. The article according to claim 22, wherein the article is selected from a gasket, a seal, a cover, and a component part, for use in an electromagnetic interference shielding device or in a radio frequency interference device.

26. An electromagnetic interference shielding and/or a radio frequency interference shielding composition, comprising:

27. at least one matrix polymer selected from a thermoplastic and/or a curable polymer having at least one functional group for crosslinking that is selected from at least one curable fluoropolymer, at least one curable perfluoropolyether, at least one perfluoropolymer, at least one curable polymer comprising silicon and fluorine, and copolymers and blends thereof; and

~~28. about 5 parts by weight to about 300 parts by weight of a carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer,~~

~~29. wherein when the composition is cured and formed into an article, it has a volume resistivity level of about 0.5 ohm-cm or less, and~~

~~30. wherein the carbon nanostructure additive is three-dimensional, branched and crosslinked.~~

~~31. The electromagnetic interference shielding and/or a radio frequency interference shielding composition according to claim 24, wherein the at least one matrix polymer is at least one curable perfluoropolymer, and wherein the composition comprises about 10 parts by weight to about 80 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one curable polymer.~~

~~32. The composition according to claim 24, wherein the at least one carbon nanostructure additive has a carbon content of greater than or equal to about 97% and a bulk density of about 0.135 g/cm^{3}.~~

~~33.~~1. A composition, comprising:

at least one matrix polymer selected from a thermoplastic and/or a curable polymer having at least one functional group for crosslinking, and

a three-dimensional, branched and/or crosslinked carbon nanostructure additive provided in an amount such that after forming an article from the composition, the article demonstrates one or more of a dissipative effect and a quantum tunneling composite effect.

~~34.~~2. The composition according to claim ~~27~~1, comprising ~~about~~ 1 part by weight to ~~about~~ 30 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

~~35.~~3. The composition according to claim ~~28~~2, comprising ~~about~~ 1 to ~~about~~ 15 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

~~36.~~4. The composition according to claim ~~27~~1, wherein when an article is formed from the composition, the article has a quantum tunneling effect, and wherein the composition comprises at least ~~about~~ 2 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

~~37.~~5. The composition according to claim ~~30~~4, wherein the composition comprises at least ~~about~~ 3 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

~~38.~~6. The composition according to claim ~~31~~5, wherein the composition comprises at least ~~about~~ 4 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

~~39.~~7. The composition according to claim ~~32~~6, wherein the composition comprises ~~about~~ 4 parts by weight to ~~about~~ 20 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

~~40.~~8. The composition according to claim ~~33~~7, wherein the composition comprises ~~about~~ 4 to ~~about~~ 15 parts by weight of the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

~~41.~~9. The composition according to claim ~~27~~1, wherein the matrix polymer is a thermoplastic polymer selected from the group consisting of polyarylene-based polymers, thermoplastic melt-processible fluoropolymers, polyvinyl chloride, polyvinylidene fluoride, polytetrafluoroethylene, chlorinated fluoropolymers, silicon-based polymers, and non-curable fluoropolymers and perfluoropolymers, polyolefins, polyethylene terephthalates, polysiloxanes, polyurethanes, polyaramid, polyamides, polyimides, polyetherimides, polyphenylene sulfides, polyphenylene sulfones, polyether sulfones, polyamideimides, polybenizmidizoles, polycarbonates, polyacrylonitrile-butadiene-styrenes, polybutadiene-styrenes, polyepoxides, and similar materials, as well as blends, copolymers, alloys, and other combinations thereof.

~~42.~~10. The composition according to claim ~~27~~1, further comprising at least one conductive filler different from the carbon nanostructure additive that is selected from the group consisting of powders, flakes and fiber fillers comprising one or more of carbon, metal-plated glass, metal-plated particles, wherein the particle comprises a metal or a polymer, nickel-coated graphite, graphene, graphite, carbon black, graphene derivatives, single-wall carbon nanotubes, multi-wall carbon nanotubes, gold, silver, nickel, copper, and combinations or mixtures thereof.

~~43.~~11. The composition according to claim ~~36~~10, wherein the composition comprises ~~about~~ 0.25 parts by weight to ~~about~~ 100 parts by weight of the one more conductive fillers different from the carbon nanostructure additive per 100 parts by weight of the at least one matrix polymer.

~~44.~~12. An article formed from the composition according to claim ~~27~~1.

~~45.~~13. The article according to claim ~~38~~12, wherein the article is an elastomeric quantum tunneling composite, and is selected from the group consisting of a seal, gasket, or other component in a sealing assembly.

~~46.~~14. The article according to claim ~~38~~12, wherein when the article is not subjected to compressive stress, it is an insulator and when subjected to compressive stress is conductive.

~~47.~~15. The article according to claim ~~38~~12, wherein the article is an elastomeric quantum tunneling composite and is a self-sensing article, and wherein when the article is in electrical communication with a circuit and a voltage is applied, a change in conductivity of the article is measured when the article is in use and subject to compressive stress and the change in conductivity is used to determine and evaluate the performance of the article in real time.

~~48. A method of making an article, comprising~~

~~49. providing a composition comprising at least one matrix polymer selected from a thermoplastic and/or a curable polymer having at least one functional group for crosslinking and at least one carbon nanostructure additive that is three-dimensional, branched and/or crosslinked, wherein the at least one carbon nanostructure additive is present in an amount of about 0.1 part by weight to about 300 parts by weight per 100 parts by weight of the at least one matrix polymer; and~~

~~50. forming an article from the composition by either heat-forming the composition or by curing and heat-forming the composition, wherein the article may be used in at least one of an electromagnetic shielding device and a radio frequency shielding device.~~

~~51. The method according to claim 42, wherein the article has a volume resistivity of about 0.5 ohm-cm or less.~~

~~52. The method according to claim 42, wherein the at least one matrix polymer is a curable polymer and the composition further comprises at least one crosslinking additive for reacting with the at least one functional group for crosslinking.~~

~~53. The method according to claim 42, wherein the article is selected from a seal, a gasket, a cover or a component part of an electromagnetic interference shielding device and/or a radio frequency interference shielding device.~~

~~54.~~16. A method of making an article, comprising

providing a composition comprising at least one matrix polymer selected from a thermoplastic and/or a curable polymer having at least one functional group for crosslinking and at least one carbon nanostructure additive that is three-dimensional, branched and

crosslinked, wherein the at least one carbon nanostructure additive is present in an amount of ~~about~~ at least ~~about~~ 1 part by weight to ~~about~~ 30 parts by weight per 100 parts by weight of the at least one matrix polymer; and

forming an article from the composition by either heat-forming the composition or by curing and heat-forming the composition, wherein the article exhibits at least one of a dissipative effect or a quantum tunneling effect.

~~55.~~17. The method according to claim ~~46~~16, wherein the article is a seal, gasket, or other component in a sealing assembly.

~~56.~~18. The method according to claim ~~46~~16, wherein the matrix polymer is a curable polymer and the composition comprises at least one crosslinking additive for reacting with the at least one functional group for crosslinking.

~~57.~~19. The method according to claim ~~46~~16, wherein the curable polymer is selected from the group consisting of a curable fluoropolymer, a curable perfluoropolyether, and a curable perfluoropolymer, and blends and copolymers, thereof.

~~58.~~20. The method according to claim ~~46~~16, wherein the article is an elastomeric quantum tunneling composite.

~~59.~~21. The method according to claim ~~46~~16, wherein when the article is not subjected to compressive stress, it is an insulator and when subjected to compressive stress is conductive.

~~60.~~22. The method according to claim ~~46~~16, wherein when the article is conductive when not subjected to compressive stress and has a conductivity level that is different than a conductivity level when the article is subjected to compressive stress.

~~61.~~23. The method according to claim ~~52~~22, wherein the conductivity level of the article when subjected to compressive stress is higher than the conductivity level of the article when not subjected to compressive stress.

~~62.~~24. The method according to claim ~~46~~16, wherein the article is an elastomeric quantum tunneling composite and is a self-sensing article, and wherein when the article is in electrical communication with a circuit and a voltage is applied, a change in conductivity of the article is measured when the article is in use and subject to compressive stress and the change in conductivity is used to determine and evaluate the performance of the article in real time.