CLAIMS

We claim:

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.

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

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

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

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

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

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

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

9. 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.

10. The composition according to claim 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.

11. The composition according to claim 10, wherein the composition comprises 0.25 parts by weight to 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.

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

13. The article according to claim 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.

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

15. The article according to claim 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.

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 at

least 1 part by weight to 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.

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

18. The method according to claim 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.

19. The method according to claim 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.

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

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

22. The method according to claim 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.

23. The method according to claim 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.

24. The method according to claim 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.