WHAT IS CLAIMED IS:

1. A thermoplastic elastomer tube comprising:

a thermoplastic elastomer component disposed within a matrix, wherein the thermoplastic elastomer component is disposed within the matrix in a thermoplastic elastomer phase having a number of domains, and wherein at least approximately 50% of the domains of the thermoplastic elastomer component have an aspect ratio of no greater than approximately 1.5.

2. The thermoplastic elastomer tube as recited in claim 1, wherein the aspect ratio is no greater than approximately 1.4, no greater than approximately 1.2, no greater than approximately 0.9, at least approximately 0.5, at least approximately 0.8, or at least approximately 1.3.

3. The thermoplastic elastomer tube as recited in any one of the preceding claims, wherein the matrix includes a polyolefin phase having a number of domains of a polyolefin component, wherein at least approximately 50% of the domains of the polyolefin component have an aspect ratio of no greater than approximately 1.5.

4. A thermoplastic elastomer tube comprising:

a thermoplastic elastomer component including at least a polymeric portion, wherein a molecular weight of the polymeric portion is at least approximately 70% of a molecular weight of an unprocessed sample of the polymeric portion.

5. The thermoplastic elastomer tube as recited in claim 4, wherein the molecular weight of the polymeric portion is no greater than approximately 95% of the molecular weight of the unprocessed sample of the polymeric portion, no greater than approximately 85% of the molecular weight of the unprocessed sample of the polymeric portion, at least approximately 75% of the molecular weight of the unprocessed sample of the polymeric portion, at least approximately 80% of the molecular weight of the unprocessed sample of the polymeric portion, or at least approximately 90% of the molecular weight of the unprocessed sample of the polymeric portion.

6. The thermoplastic elastomer tube as recited in claim 4 or 5, wherein the molecular weight of the polymeric portion is no greater than approximately 275,000, no greater than approximately 230,000, no greater than approximately 210,000, no greater than approximately 190,000, no greater than approximately 175,000, at least approximately 120,000, at least approximately 135,000, at least approximately 150,000, or at least approximately 165,000.

7. The thermoplastic elastomer tube as recited in any one of claims 4 to 6, wherein the molecular weight of the unprocessed sample of the polymeric portion is no greater than approximately 300,000, no greater than approximately 255,000, no greater than approximately 210,000, no greater than approximately 180,000, at least approximately 150,000, at least approximately 165,000, at least approximately 175,000, or at least approximately 185,000.

8. The thermoplastic elastomer tube as recited in any one of claims 4 to 7, wherein the thermoplastic elastomer tube further comprises a polyolefin component.

9. A thermoplastic elastomer tube comprising:

at least approximately 20 wt% of a thermoplastic elastomer component comprising styrene; and

no greater than approximately 50 wt% of a polyolefin component;

wherein the thermoplastic elastomer tube has a tensile strength of at least approximately 1000 psi.

10. An apparatus comprising:

a thermoplastic elastomer tube comprising at least approximately 20 wt% of a thermoplastic elastomer component comprising styrene and no greater than approximately 50 wt% of a polyolefin component, wherein the thermoplastic elastomer tube has a tensile strength of at least approximately 1000 psi; and

a pump to dispense fluid via the thermoplastic elastomer tube.

11. The apparatus as recited in claim 10, wherein the thermoplastic elastomer tube and the pump comprise a medical device to provide the fluid to a patient.

12. The thermoplastic elastomer tube or the apparatus as recited in any one of claims 9 to 11, wherein the tensile strength of the thermoplastic elastomer tube is no greater than approximately 2150 psi, no greater than approximately 2100 psi, no greater than approximately 1950 psi, no greater than approximately 1850 psi, at least approximately 1000 psi, at least approximately 1750 psi, at least approximately 1800 psi, or at least approximately 1900 psi.

13. A process comprising:

providing a number of starting materials to a twin screw extruder, the starting materials including a thermoplastic elastomer;

mixing the starting materials in the twin screw extruder to provide a twin screw extruder output;

providing the twin screw extruder output to a pump; and

providing an output of the pump to a die to form a thermoplastic elastomer tube.

14. The process as recited in claim 13, further comprising heating the number of starting materials in the twin screw extruder to form a melt.

15. The process as recited in claim 14, wherein a temperature of the melt is no greater than approximately 230°C, no greater than approximately 205°C, no greater than approximately 195°C, no greater than approximately 190°C, no greater than approximately 185°C, or no greater than approximately 175°C, or no greater than approximately 160°C.

16. The process as recited in any one of claims 13 to 15, wherein a first portion of the number of starting materials comprise solid materials, a second portion of the number of starting materials comprise liquid materials, a third portion of the number of starting materials comprise gaseous materials, or a combination thereof.

17. The process as recited in any one of claims 13 to 17, wherein a pressure at an input of the die varies by no greater than approximately 10% from a specified input pressure, no greater than approximately 8% from the specified input pressure, no greater than approximately 6% from the specified input pressure, no greater than approximately 4% from the specified input pressure, or no greater than approximately 2% from the specified input pressure.

18. The process as recited in any one of claims 13 to 17, wherein the output of the pump is provided to the die and mandrel via one or more filtering devices.

19. The process as recited in any one of claims 13 to 18, further comprising cooling the thermoplastic elastomer tube.

20. The process as recited in claim 19, wherein the thermoplastic elastomer tube is cooled after providing the output of the pump to the die.

21. The process as recited in claim 19 or 20, wherein the thermoplastic elastomer tube is cooled via a water bath.

22. The process as recited in claim 21, wherein the water bath is disposed in a vacuum tank, open to the atmosphere, or both.

23. The process as recited in any one of claims 13 to 22, further comprising blending the starting materials before providing the starting materials to the twin screw extruder.

24. The process as recited in any one of claims 13 to 23, wherein the twin screw extruder is driven by a gear pump.

25. The process as recited in any one of claims 13 to 24, wherein the pump is a positive displacement pump.

26. The process as recited in claim 25, wherein the positive displacement pump is a melt pump.

27. The process as recited in any one of claims 13 to 26, wherein the pump is a single screw extruder.

28. The process as recited in claim 27, wherein the single screw extruder has a ratio of length to diameter (L/D) of no greater than approximately 24, no greater than approximately 16, or no greater than approximately 8.

29. The process as recited in any one of claims 13 to 28, further comprising providing one or more of the starting materials to the twin screw extruder via one or more liquid injection pumps.

30. The process as recited in claim 13 to 29, further comprising providing one or more of the starting materials to the twin screw extruder via one or more feeders coupled to the twin screw extruder.

31. The process as recited in any one of claims 13 to 30, further comprising providing at least a portion of the starting materials to the twin screw extruder via a side feeder.

32. The process as recited in any one of claims 13 to 31, wherein the thermoplastic elastomer tube comprises a thermoplastic elastomer component and a polyolefin component.

33. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 1 to 12 and 32, wherein the thermoplastic elastomer tube has a 100% elongation modulus of no greater than approximately 510 psi, no greater than approximately 500 psi, no greater than approximately 475 psi, no greater than approximately 450 psi, no greater than approximately 430 psi, at least approximately 400 psi, at least approximately 425 psi, at least approximately 460 psi, or at least approximately 470 psi.

34. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 1 to 12, 32, and 33, wherein the thermoplastic elastomer tube has a 300% elongation modulus of no greater than approximately 700 psi, no greater than approximately 675 psi, no greater than approximately 650 psi, no greater than approximately 625 psi, at least approximately 600 psi, at least approximately 630 psi, at least approximately 660 psi, or at least approximately 680 psi.

35. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 1 to 12 and 32 to 34, wherein the thermoplastic elastomer tube has a Graves tear strength of no greater than approximately 270 pli, no greater than approximately 260 pli, no greater than approximately 235 pli, no greater than approximately 225 pli, at least approximately 180 pli, at least approximately 200 pli, at least approximately 220 pli, or at least approximately 250 pli.

36. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 1 to 12 and 32 to 35, wherein the thermoplastic elastomer tube has a burst pressure of no greater than approximately 100 psi, no greater than approximately 95 psi, no greater than approximately 85 psi, no greater than approximately 75 psi, at least approximately 65 psi, at least approximately 70 psi, at least approximately 80 psi, or at least approximately 90 psi.

37. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 1 to 12 and 32 to 37, wherein the thermoplastic elastomer tube has an enthalpy of mixing of no greater than approximately 21 J/g, no greater than approximately 20 J/g, no greater than approximately 17.5 J/g, no greater than approximately 16 J/g, at least approximately 15 J/g, at least approximately 16.5 J/g, at least approximately 18 J/g, or at least approximately 19 J/g.

38. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 1 to 12 and 32 to 37, wherein the thermoplastic elastomer tube has a shore A hardness of no greater than approximately 80, no greater than approximately 75, no greater than approximately 65, no greater than approximately 50, at least approximately 40, at least approximately 45, at least approximately 55, at least approximately 60, or at least approximately 70.

39. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 3, 8, 9 to 12, and 32 to 38, wherein the thermoplastic elastomer component includes a mixture of a plurality of polymers.

40. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 3, 8, 9 to 12, and 32 to 39, wherein the thermoplastic elastomer component includes a co-polymer.

41. The thermoplastic elastomer tube, apparatus, or process as recited in claim 40, wherein the co-polymer comprises a block co-polymer.

42. The thermoplastic elastomer tube, apparatus, or process as recited in claim 41, wherein the block co-polymer comprises a mixture of a plurality of formulations of block-co-polymers containing styrene.

43. The thermoplastic elastomer tube, apparatus, or process as recited in claim 41 or 42, wherein the block co-polymer is selected from a group containing a styrene-butadiene-styrene block co-polymer, a styrene-isoprene-styrene block co-polymer, a styrene-isoprene/butadiene-styrene block co-polymer, a hydrogenated block co-polymer, or combinations thereof.

44. The thermoplastic elastomer tube, apparatus, or process as recited in claim 43, wherein the hydrogenated block co-polymer includes a styrene-ethylene-butylene-styrene (SEBS) block co-polymer, a styrene-ethylene-propylene-styrene (SEPS) block co-polymer, a styrene-ethylene-ethylene/propylene-styrene (SEEPS) block co-polymer, or a combination thereof.

45. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 3, 8, 9 to 12, and 32 to 42, wherein the thermoplastic elastomer component is selected from a group containing a polyether-ester block co-polymer, a thermoplastic polyamide elastomer, a thermoplastic polyurethane elastomer, a thermoplastic polyolefin elastomer, a thermoplastic vulcanizate, a polyolefin plastomer, an olefin-based co-polymer, an olefin-based ter-polymer, a flexible polyvinylchloride, or combinations thereof.

46. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 3, 8, 9 to 12, and 32 to 45, wherein the thermoplastic elastomer tube comprises no greater than approximately 60 wt% of the thermoplastic elastomer component, no greater than approximately 55 wt% of the thermoplastic elastomer component, no greater than approximately 40 wt% of the thermoplastic elastomer component, at least approximately 25 wt% of the thermoplastic elastomer component, at least approximately 30 wt% of the thermoplastic elastomer component, or at least approximately 45 wt% of the thermoplastic elastomer component.

47. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 3, 8, 9 to 12, and 32 to 46, wherein the thermoplastic elastomer tube comprises no greater than approximately 45 wt% of the polyolefin component, no greater than approximately 40 wt% of the polyolefin component, no greater than approximately 35 wt% of the polyolefin component, no greater than approximately 25 wt% of the polyolefin component, at least approximately 10 wt% of the polyolefin component, at least approximately 15 wt% of the polyolefin component, at least approximately 20% of the polyolefin component, or at least approximately 30 wt% of the polyolefin component.

48. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 3, 8, 9 to 12, and 32 to 47, wherein the polyolefin component includes a mixture of a plurality of formulations of polyolefins.

49. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 3, 8, 9 to 12, and 32 to 48, wherein the polyolefin component includes a polypropylene.

50. The thermoplastic elastomer tube, apparatus, or process as recited in any one of the preceding claims, wherein the thermoplastic elastomer tube includes a plasticizer.

51. The thermoplastic elastomer tube, apparatus, or process as recited in claim 50, wherein the plasticizer is mineral oil.

52. The thermoplastic elastomer tube, apparatus, or process as recited in claim 51, wherein the thermoplastic elastomer tube includes no greater than approximately 70 wt% mineral oil, no greater than approximately 60 wt% mineral oil, no greater than approximately 45 wt% mineral oil, no greater than approximately 35 wt% mineral oil, at least approximately 20 wt% mineral oil, at least approximately 40 wt% mineral oil, or at least approximately 50 wt% mineral oil.

53. The thermoplastic elastomer tube, apparatus, or process as recited in any one of the preceding claims, wherein the thermoplastic elastomer tube includes one or more additives.

54. The thermoplastic elastomer tube, apparatus, or process as recited in claim 53, wherein the one or more additives are selected from a group containing a silicone modifier, a stabilizer, a curing agent, a lubricant, a colorant, a filler, a blowing agent, an additional polymer, or any combination thereof.

55. The thermoplastic elastomer tube, apparatus, or process as recited in any one of the preceding claims, wherein the thermoplastic elastomer tube includes a hollow body having an inner bore and having an inner diameter, an outer diameter, and a length.

56. The thermoplastic elastomer tube, apparatus, or process as recited in claim 55, wherein the inner diameter is no greater than approximately 25 mm, no greater than approximately 20 mm, no greater than approximately 10 mm, at least approximately 0.5 mm, at least approximately 5 mm, or at least approximately 15 mm.

57. The thermoplastic elastomer tube, apparatus, or process as recited in claim 55 or 56, wherein the outer diameter is no greater than approximately 40 mm, no greater than approximately 30 mm, no greater than approximately 25 mm, no greater than approximately 10 mm, at least approximately 5 mm, at least approximately 15 mm, or at least approximately 20 mm.

58. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 55 to 57, wherein the thermoplastic elastomer tube has a wall thickness of no greater than approximately 17 mm, no greater than approximately 15 mm, no greater than approximately 12 mm, no greater than approximately 10 mm, at least approximately 0.5 mm, at least approximately 2 mm, at least approximately 5 mm, or at least approximately 7 mm.

59. The thermoplastic elastomer tube, apparatus, or process as recited in any one of claims 55 to 58, wherein the length of the thermoplastic elastomer tube is no greater than approximately 100 cm, no greater than approximately 80 cm, no greater than approximately 65 cm, no greater than approximately 55 cm, at least approximately 5 cm, at least approximately 25 cm, at least approximately 35 cm, or at least approximately 45 cm.

60. The thermoplastic elastomer tube, apparatus, or process as recited in any one of the preceding claims, wherein the thermoplastic elastomer tube is formed from thermoplastic elastomer tubing having a length of no greater than approximately 800 m, no greater than approximately 650 m, no greater than approximately 400 m, no greater than approximately 200 m, no greater than approximately 75 m, at least approximately 10 m, at least approximately 35 m, at least approximately 50 m, at least approximately 125 m, at least approximately 350 m, or at least approximately 500 m.

61. The thermoplastic elastomer tube, apparatus, or process as recited in any one of the preceding claims, wherein the thermoplastic elastomer tube has a plurality of layers.

62. Thermoplastic elastomer tubing comprising:

a hollow body having an inner diameter, an outer diameter, and a length;

a thermoplastic elastomer component disposed within a matrix; and

wherein a standard deviation of the outer diameter is no greater than approximately 1.5% of an average outer diameter of the hollow body over the length.

63. The thermoplastic elastomer tubing as recited in claim 62, wherein the length is no greater than approximately 50 m, no greater than approximately 30 m, no greater than approximately 30 m, at least approximately 10 m, at least approximately 15 m, at least approximately 25 m, or at least approximately 40 m.

CLAIMS

1. A thermoplastic elastomer tube comprising:

a matrix including a thermoplastic elastomer phase, the thermoplastic elastomer phase comprising a plurality of domains comprising a thermoplastic elastomer component, wherein at least approximately 50% of the plurality of domains comprising the thermoplastic elastomer component have an aspect ratio of no greater than approximately 1.5, and

wherein (a) the thermoplastic elastomer tube comprises no greater than approximately 60 wt % of the thermoplastic elastomer component and at least approximately 25 wt % of the thermoplastic elastomer component, (b) an average value of a major dimension of the plurality of domains is at least 1.2 microns, or both.

2. The thermoplastic elastomer tube as recited in claim 1, wherein the matrix further includes a polyolefin phase comprising a plurality of domains of a polyolefin component, wherein at least approximately 50% of the plurality of domains comprising the polyolefin component have an aspect ratio of no greater than approximately 1.5.

3. The thermoplastic elastomer tube as recited in claim 1, wherein the tensile strength of the thermoplastic elastomer tube is at least approximately 1000 psi.

4. The thermoplastic elastomer tube as recited in claim 1, wherein the thermoplastic elastomer tube has a 100% elongation modulus of at least approximately 400 psi.

5. The thermoplastic elastomer tube as recited in claim 1, wherein the thermoplastic elastomer tube has a 300% elongation modulus of at least approximately 600 psi.

6. The thermoplastic elastomer tube as recited in claim 1, wherein the thermoplastic elastomer tube has a Graves tear strength of at least approximately 180 ph.

7. The thermoplastic elastomer tube as recited in claim 1, wherein the thermoplastic elastomer tube has a burst pressure of at least approximately 65 psi.

8. The thermoplastic elastomer tube as recited in claim 1, wherein the thermoplastic elastomer tube has a shore A hardness of no greater than approximately 80.

9. The thermoplastic elastomer tube as recited in claim 11, wherein the styrenic block co-polymer includes a styrene-butadiene-styrene block co-polymer, a styrene-isoprene-styrene block co-polymer, a styrene-isoprene/butadiene-styrene block co-polymer, a styrene-ethylene-butylene-styrene (SEBS) block co-polymer, a styrene-ethylene-butadiene-styrene

block copolymer, a styrene-ethylene-propylene-styrene (SEPS) block co-polymer, a styrene-ethylene-ethylene/propylene-styrene (SEEPS) block co-polymer, and combinations thereof.

10. The thermoplastic elastomer tube as recited in claim 11, wherein the thermoplastic polyolefin elastomer includes a polyolefin plastomer, an olefin-based co-polymer, an olefin-based ter-polymer, and combinations thereof.

11. The thermoplastic elastomer tube as recited in claim 1, wherein the thermoplastic elastomer component includes a styrenic block co-polymer, a polyether-ester block co-polymer, a thermoplastic polyamide elastomer, a thermoplastic polyurethane elastomer, a thermoplastic polyolefin elastomer, a thermoplastic vulcanizate, a polyvinylchloride, or combinations thereof.

12. The thermoplastic elastomer tube as recited in claim 1, wherein the thermoplastic elastomer tube comprises at least approximately 25 wt % of the thermoplastic elastomer component and no greater than approximately 55 wt % of the thermoplastic elastomer component.

13. The thermoplastic elastomer tube as recited in claim 1, further comprising a polyolefin component, and wherein the thermoplastic elastomer tube comprises no greater than approximately 45 wt % of the polyolefin component and at least approximately 10 wt % of the polyolefin component.

14. The thermoplastic elastomer tube as recited in claim 1, further comprising a polyolefin component, and wherein the polyolefin component includes a polypropylene.

15. The thermoplastic elastomer tube as recited in claim 1, wherein the thermoplastic elastomer tube includes a plasticizer comprising a mineral oil.

16. The thermoplastic elastomer tube as recited in claim 15, wherein the thermoplastic elastomer tube includes no greater than approximately 70 wt % mineral oil.

17. An apparatus comprising:

the thermoplastic elastomer tube as recited in claim 1; and

a pump to dispense fluid via the thermoplastic elastomer tube.

18. The apparatus as recited in claim 17, wherein the thermoplastic elastomer tube and the pump comprise a medical device to provide the fluid to a patient.

19. A thermoplastic elastomer tube comprising:

a matrix including a thermoplastic elastomer phase, the thermoplastic elastomer phase comprising a plurality of domains comprising a thermoplastic elastomer component,

wherein at least approximately 50% of the plurality of domains comprising the thermoplastic elastomer component have an aspect ratio of no greater than approximately 1.5, and

wherein the thermoplastic elastomer tube comprises no greater than approximately 60 wt % of the thermoplastic elastomer component and at least approximately 25 wt % of the thermoplastic elastomer component.

20. A thermoplastic elastomer tube comprising:

a matrix including a thermoplastic elastomer phase, the thermoplastic elastomer phase comprising a plurality of domains comprising a thermoplastic elastomer component,

wherein at least approximately 50% of the plurality of domains comprising the thermoplastic elastomer component have an aspect ratio of no greater than approximately 1.5, and

wherein an average value of a major dimension of the plurality of domains is at least 1.2 microns.