CLAIMS:

1. An expandable sheath for deploying a medical device, comprising:

a first polymeric layer;

a braided layer radially outward of the first polymeric layer, the braided layer comprising a plurality of filaments braided together;

a resilient elastic layer radially outward of the braided layer, the elastic layer being configured to apply radial force to the braided layer and the first polymeric layer; and

a second polymeric layer radially outward of the elastic layer and bonded to the first polymeric layer such that the braided layer and the elastic layer are encapsulated between the first and second polymeric layers;

wherein the plurality of filaments of the braided layer are movable between the first and second polymeric layers such that the braided layer is configured to radially expand as a medical device is passed through the sheath;

wherein when the medical device is passed through the sheath, the diameter of the sheath expands from a first diameter to a second diameter around the medical device while the first and second polymeric layers resist axial elongation of the sheath such that a length of the sheath remains substantially constant; and

wherein the sheath resiliently returns to the first diameter by radial force applied by the elastic layer upon passage of the medical device.

2. The expandable sheath of claim 1, wherein:

the first and second polymeric layers comprise a plurality of longitudinally-extending folds when the sheath is at the first diameter.

3. The expandable sheath of claim 2, wherein the longitudinally extending folds create a plurality of circumferentially spaced ridges and a plurality of circumferentially spaced valleys.

4. The expandable sheath of claim 3, wherein, as a medical device is passed through the sheath, the ridges and valleys level out to allow the sheath to radially expand.

5. The expandable sheath of any one of claims 1-4, wherein the elastic layer comprises one or more elastic bands helically wound over the braided layer.

6. The expandable sheath of claim 5, wherein the elastic layer comprises two elastic bands wound with opposite helicity.

7. The expandable sheath of claim 1, wherein the filaments of the braided layer are not engaged or adhered to the first or second polymeric layers.

8. The expandable sheath of any one of claims 1-7, wherein the filaments of the braided layer are resiliently buckled when the sheath is at the first diameter.

9. The expandable sheath of claim 8, wherein the first and second polymeric layers are attached to each other at a plurality of open spaces between the filaments of the braided layer.

10. The expandable sheath of any one of claims 1-9, further comprising one or more longitudinally extending cords attached to the braided layer.

11. The expandable sheath of any one of claims 1-10, further comprising an outer cover extending longitudinally beyond distal ends of the first polymeric layer, the braided layer, the elastic layer, and the second polymeric layer to form an overhang.

12. The expandable sheath of claim 11, wherein the outer cover comprises one or more longitudinally extending slits, weakened portions, or scorelines.

13. The expandable sheath of claim 11, wherein the outer cover is formed of a heat-shrink material.

14. The expandable sheath of claim 11, wherein the outer cover is elastomeric.

15. A method of making an expandable sheath, the method comprising:

placing a braided layer radially outward of a first polymeric layer situated on a mandrel, the braided layer comprising a plurality of filaments braided together, the mandrel having a first diameter;

applying an elastic layer radially outward of the braided layer, the elastic layer being configured to apply radial force to the first polymeric layer and the braided layer;

applying a second polymeric layer radially outward of the elastic layer;

applying heat and pressure to the first polymeric layer, the braided layer, the elastic layer, and the second polymeric layer such that the first and second polymeric layers bond to each other and encapsulate the braided layer and the elastic layer to form an expandable sheath; and

removing the expandable sheath from the mandrel to allow the expandable sheath to at least partially radially collapse to a second diameter that is less than the first diameter under radial force applied by the elastic layer.

16. The method of claim 15, wherein applying the elastic layer further comprises wrapping one or more elastic bands around the braided layer.

17. The method of claim 16, wherein applying an elastic layer further comprises applying the one or more elastic bands in a stretched configuration.

18. The method of claim 16, wherein after application of the braided layer, the method further comprises removing the first polymeric layer and the braided layer from the mandrel, applying the elastic layer in a relaxed or a moderately stretched state, and placing the first polymeric layer, the braided layer, and the elastic layer back on the mandrel to stretch the elastic layer prior to application of the second polymeric layer.

19. The method of any one of claims 15-18, wherein applying heat and pressure further comprises placing the mandrel in a vessel containing a thermally-expandable material, and heating the thermally-expandable material in the vessel.

20. The method of claim 19, wherein applying heat and pressure further comprises applying a radial pressure of 100 MPa or more to the mandrel via the thermally-expandable material.

21. The method any one of claims 15-20, wherein applying heat and pressure further comprises applying a heat shrink tubing layer over the second polymeric layer and applying heat to the heat shrink tubing layer.

22. The method any one of claims 15-21, further comprising resiliently buckling the filaments of the braided layer as the sheath is radially collapsed to the second diameter.

23. The method any one of claims 15-22, further comprising press fitting the removed expandable sheath into an outer cover such that the outer cover extends distally off distal ends of the first polymeric layer, the braided layer, the elastic layer, and the second polymeric layer at an overhang.

24. The method of claim 23, wherein the outer cover is a heat shrink tubing.

25. The method of claim 23, wherein the outer cover is elastomeric.

26. The method any one of claims 15-25, further comprising attaching one or more longitudinally extending cords to the braided layer to prevent axial elongation of the braided layer.

27. The method any one of claims 15-26, further comprising crimping the expandable sheath to a third diameter, the third diameter being smaller than the first diameter and the second diameter.

28. The method of claim 27, wherein crimping the expandable sheath comprises supporting an inner surface of the entire length of the uncrimped sheath on an elongated mandrel having a conical end portion, the conical end portion nested within a narrowing lumen of a crimping mechanism, advancing the expandable sheath over the conical end portion and through the narrowing lumen while the uncrimped portion is supported by the mandrel, and compressing the sheath to the third, crimped diameter via pressure from an interior surface of the narrowing lumen of the crimping piece.

29. The method of claim 27, wherein crimping the expandable sheath comprises contacting an end of the sheath with a plurality of radially arranged disc-shaped rollers, advancing the sheath through the plurality of disc-shaped rollers, and compressing the sheath to the third, crimped diameter via pressure from a circular edge of each disc-shaped roller as it rolls along an outer surface of the sheath.

30. The method of claim 27, wherein crimping the expandable sheath comprises applying a first heat shrink tube to an outer surface of the sheath, compressing the sheath by shrinking the first heat shrink tube to an intermediate diameter, removing the first heat shrink tube, applying a second heat shrink tube to an outer surface of the sheath, compressing the sheath by shrinking the second heat shrink tube to a diameter smaller than the intermediate diameter, and removing the second heat shrink tube.

31. The method of claim 30, further comprising applying and shrinking additional, consecutively smaller heat shrink tubes until the sheath is compressed to the third diameter.

32. An assembly, comprising:

the expandable sheath of any one of claims 1-14 or 40-41, further comprising a distal end portion resiliently expandable between the first diameter and a second diameter;

a vessel dilator disposed within the sheath, the vessel dilator comprising a tapered nose cone and a retaining member that extends at least partially over the distal end portion of the sheath and is configured to retain the distal end portion of the sheath at the first diameter.

33. The assembly of claim 32, wherein the distal end portion is heat-set toward an expanded configuration, and the elastic layer of the sheath terminates proximally of the distal end of the sheath.

34. The assembly of either of claims 32 or 33, wherein a distal end portion of the braided layer is heat-set toward a flared configuration.

35. The assembly of any one of claims 32-34, wherein the retaining member is a polymeric heat-shrink layer.

36. The assembly of any one of claims 32-35, wherein the retaining member is elastomeric and configured to compress the distal end portion of the sheath.

37. The assembly of any one of claims 32-36, wherein the retaining member is glued or fused to the sheath.

38. The assembly of any one of claims 32-37, wherein the retaining mechanism comprises a shaft disposed between the dilator and the sheath, the shaft comprising a releasable coupling that mechanically engages both the dilator and the sheath and that can be manually deactivated.

39. The assembly of any one of claims 32-38, wherein the retaining mechanism comprises one or more balloons disposed between the dilator and the sheath.

40. The device of any one of claims 1-14, wherein a distal end portion of the second polymeric layer extends longitudinally beyond distal ends of the first polymeric layer, the braided layer, and the elastic layer.

41. The device of claim 40, wherein the distal end portion comprises multiple circumferential folds when the sheath is in a collapsed configuration.

42. The device of claim 42, wherein the distal end portion comprises multiple layers of polymer material.