CLAIMS

What is claimed is:

1. A flexible microtube comprising a polymer, the microtube having an inner diameter of about 4 μm to about 1000 μm, and an outer diameter, wherein the inner surface of the microtube replicates the contour of a metal wire template used to define the inner diameter of the microtube, and having a length and uniform cross-sectional inner diameter throughout the microtube defined by the metal wire template.

2. The microtube of claim 1, wherein the polymer is a silicone elastomer, an ultraviolet sensitive polymer, a conductive polymer, polyurethane, a thermoplastic polymer, a thermoset polymer, a polyimide, or a conductive rubber.

3. The microtube of claim 2, wherein the silicone elastomer is polydimethylsiloxane, phenyl-vinyl silicone, methyl-siloxane, platinum cured silicone rubber or fluoro-siloxane.

4. The microtube of claim 2, wherein the ultraviolet sensitive polymer is a fluorinated resin with acrylate/methacrylate groups, styrene-acrylate-containing polymer, polyacrylate polyalkoxy silane, a positive photoresist or a negative photoresist.

5. The microtube of claim 1, wherein the microtube inner diameter is between about 10 μm and about 800 μm.

6. The microtube of claim 1, wherein the length of the microtube is about 10 m or less.

7. The microtube of claim 1, wherein the microtube is gas permeable.

8. The microtube of claim 1, wherein the microtube is transparent.

9. The microtube of claim 1, wherein the microtube is biocompatible.

10. A method of making a flexible microtube comprising a polymer, the method comprising:

immersing a wire into a pool comprising heat curable polymer;

heating the wire for a first period of time, thereby initiating curing of the heat curable polymer at the surface of the wire;

pulling the wire out of the pool;

heating the wire for a second period of time, thereby curing additional heat curable polymer and producing a polymer coated wire;

immersing the polymer coated wire in a liquid bath with sonication, thereby loosening the polymer-wire contact;

removing the wire from the polymer coated wire, thereby producing a polymeric microtube; and

heating the polymeric microtube, thereby producing the flexible microtube having an inner diameter of about 4 μm to about 1000 μm, and an outer diameter, wherein the inner diameter and outer diameter are uniform in their respective diameters throughout the length of the microtube.

11. The method of claim 10, wherein

the heating for a first period of time is performed via electric current along the wire,

the heating for a second period of time is performed via a hot air heating element,

the liquid bath is an acetone bath, and

the heating of the polymeric microtube is performed via baking.

12. A method of making a flexible microtube comprising a polymer, the method comprising:

immersing a wire into a pool comprising a pre-cured ultraviolet-curable polymer;

pulling the wire out of the pool and into an argon chamber;

curing a layer of ultraviolet-curable polymer coated around the wire under an ultraviolet mercury lamp, thereby producing a polymer coated wire;

immersing the polymer coated wire in a liquid bath with sonication, thereby loosening the polymer-wire contact;

removing the wire from the polymer coated wire, thereby producing a polymeric microtube; and

heating the polymeric microtube, thereby producing the flexible microtube having an inner diameter of about 4 μm to about 1000 μm, and an outer diameter, wherein the inner diameter and outer diameter are uniform in their respective diameters throughout the length of the microtube.

13. A device comprising the microtube produced by the method of any one of claims 10-12.

14. The device of claim 13, wherein the device is a biomedical device.

15. The device of claim 14, wherein the biomedical device is an artificial skin, organ-on-chip, blood vessel mimicking device, capillary network mimicking device, opto-microfluidic device, a 3D bioreactor, drug delivery device, cell stretcher, tissue engineering scaffold, micro-pump or micro-valve.

16. The microtube of one of claims 1-9, wherein the microtube has a circular, rectangular, square, triangular, elliptical, star or irregular cross-sectional shape.

17. A flexible microtube produced by the method of any one of claims 10-12.

18. The flexible microtube of claim 17, wherein the polymer is a silicone elastomer, an ultraviolet sensitive polymer, a conductive polymer, polyurethane, a thermoplastic polymer, a thermoset polymer, a polyimide, or a conductive rubber.

19. The flexible microtube of claim 17, wherein the polymer is polydimethylsiloxane.

20. The flexible microtube of claim 17, wherein the polymer is a fluorinated resin with acrylate/methacrylate groups.

21. A method of making a flexible microtube comprising a polymer, the method comprising:

immersing a wire into a pool comprising heat curable polymer;

heating the wire for a first period of time, thereby initiating curing of the heat curable polymer at the surface of the wire;

pulling the wire out of the pool;

heating the wire for a second period of time, thereby curing additional heat curable polymer and producing a polymer coated wire;

immersing the polymer coated wire in a liquid bath with sonication, thereby loosening the polymer-wire contact;

removing the wire from the polymer coated wire, thereby producing a polymeric microtube; and

heating the polymeric microtube, thereby producing the flexible microtube.

22. The method of claim 21, wherein

the heating for a first period of time is performed via electric current along the wire,

the heating for a second period of time is performed via a hot air heating element,

the liquid bath is an acetone bath, and

the heating of the polymeric microtube is performed via baking.