CLAIMS

What is claimed is:

1. A fluid circuit for a predetermined fluid flow passageway having at least one inlet and at least one outlet, the fluid circuit comprising:

a plurality of tubing segments and a plurality of operative components, each operative component comprising a body portion with an internal fluid flow passageway and a plurality of tubing connector fittings, the operative components connecting the plurality of tubing segments at selected tubing connector fittings, the plurality of tubing segments and operative components providing the fluid flow passageway through the fluid circuit;

wherein each tubing segment comprises i) a non-conductive polymer portion defining the fluid passageway and ii) an one or more interior conductive stripes of conductive fluoropolymer extending axially to ends of each of the respective tubing segments, and

wherein each operative component body portion comprises a conductive fluoropolymer that extends between each of the plurality of tubing connector fittings, and

wherein each of the tubing connector fittings conductively connects the respective conductor of the body portion to the one or more interior conductive stripes of the tubing segment.

2. The fluid circuit of claim 1, wherein the plurality of operative components includes any one of a valve, a straight connector, a T-connector, an elbow connector, a multi-connector manifold, a filter, a heat exchanger, or a sensor.

3. The fluid circuit of claim~~s~~ 1~~ or 2~~, wherein the operative component is a valve comprising a body portion having a fluid passageway valve to adjust flow through the fluid passageway.

~~4. The fluid circuit of claims 1 or 2, wherein the operative component is a straight connector having a fluid passageway to connect two tubing segments.~~

~~5. The fluid circuit of claims 1 or 2, wherein the operative component is a T-connector having fluid passageways to connect three tubing segments.~~

~~6. The fluid circuit of claims 1 or 2, wherein the operative components is a multi-connector manifold having fluid passageways to connect four or more tubing segments.~~

~~7. The fluid circuit of any one of claims 1-6, wherein each of the tubing connector fittings comprise a threaded nipple portion and a fitting nut attachable to the threaded nipple portion.~~

~~8~~4. The fluid circuit of ~~any one of~~ claim~~s~~ 1~~-7~~, wherein the tubing connector fittings have one or more inlet portions comprising a male nipple portion and a fitting nut, the male nipple portion having a threaded portion for engaging the fitting nut, where the fitting nut engages a conductive fluoropolymer of the operative component with the interior conductive stripes of a tubing segment end to conductively connect the conductive fluoropolymer and the interior conductive stripes of the tubing end.

~~9~~5. The fluid circuit of ~~any one of~~ claim~~s~~ 1~~-8~~, wherein one or more of the operative components comprises an attachment feature that conductively connects a conductive polymer of the respective operative component to ground.

~~10~~6. The fluid circuit of claim~~s~~ 1~~ or 2~~, wherein the operative component is a filter comprising a body portion having a housing with a fluid passageway, a filter element and two conductive end caps with tubing connector fittings and conductive fitting nuts to conductively connect tubing segments connected to the filter, wherein the body portion has conductive exterior stripes to conductively connect the end caps.

~~11~~7. The fluid circuit ~~any one~~ of claim~~s~~ 1~~, 2 or 10~~, wherein the operative component comprises a filter having a conductive sleeve conductively connecting two conductive end caps to the exterior of the body portion.

~~12~~8. The fluid circuit of claim~~s~~ 1~~ or 2~~, wherein the operative component is a filter comprising a body portion having a housing with a fluid passageway, a filter element and a single conductive end cap with tubing connector fittings and conductive fitting nuts to conductively connect tubing segments connected to the filter.

~~13~~9. The fluid circuit ~~any one~~ of claim~~s~~ 1~~, 2 or 12~~, wherein the operative component is a filter having a conductive sleeve to conductively connect ~~the~~a single end cap to the exterior of the body portion.

~~14. The fluid circuit of any one of claims 1-13, wherein the operative components comprises filter comprises a conductive probe fitting into a drain fitting.~~

~~15. The fluid circuit of claim 14, wherein the conductive probe is attachable to ground.~~

~~16~~10. The fluid circuit of claim 1, wherein each of the plurality of operative components are conductively connected together.

~~17~~11. The fluid circuit of ~~any one of~~ claim~~s~~ 1~~-16~~, wherein ~~each one or more interior conductive stripes of the tubing segment comprises a conductive fluoropolymer and~~ each of the plurality of operative components are conductively connected together through the one or more interior conductive stripes of the tubing segments.

~~18. The fluid circuit of any of claims 1-17, wherein the tubing segments comprise 2, 4, 6 or 8 bonding and uniform conductive fluoropolymer stripes on the interior of the tubing segments.~~

~~19~~12. The fluid circuit of ~~any of~~ claim~~s~~ 1~~-18~~, wherein the tubing segments have a measured resistance of about 1.2×10^4 - 6.7×10^5 ohm.

~~20. The fluid circuit of any of claims 1-19, wherein the tubing segments have a measured resistance of about 2.5 - 4.3 x 10^4 ohm.~~

~~21. The fluid circuit of any of claims 1-20, wherein the tubing segments comprise one or more conductive fluoropolymer stripes on the exterior of the tubing segments.~~

13. The fluid circuit of claim 1, wherein the non-conductive polymer portion comprises perfluoroalkoxy alkane (PFA) polymer and the one or more interior conductive stripes comprise carbon-loaded PFA.

14. The fluid circuit of claim 1, wherein the one or more interior conductive stripes comprise spirals.

15. The fluid circuit of claim 1, wherein the one or more interior conductive stripes comprise four stripes.

16. The fluid circuit of claim 1, wherein the one or more interior conductive stripes comprise eight stripes equally distributed around a perimeter of the fluid passageway.

17. The fluid circuit of claim 1, further comprising a conductive stripe located on an outer surface of the fluid circuit.

~~22~~18. A fluid circuit defining a flow passageway for a fluid from a fluid supply toward a process stage, the fluid circuit comprising:

a plurality of tubing segments and a plurality of operative components, each operative component comprising a body portion with an internal fluid flow passageway and a plurality of tubing connector fittings, the operative components connecting the plurality of tubing segments at selected tubing connector fittings, the plurality of tubing segments and operative components providing the fluid flow passageway through the fluid circuit;

wherein each tubing segment comprises i) a non-conductive polymer portion defining the fluid passageway and ii) 2~~, 3, 4, 5, 6, 7, 8~~ or more interior conductive stripes of fluoropolymer extending axially to ends of each of the respective tubing segments,

wherein each operative component comprises a body portion comprising a conductive fluoropolymer that extends between each of the plurality of tubing connector fittings,

wherein each of the tubing connector fittings conductively connect the respective conductor of the body portion to the at least one interior conductive strip polymer of the tubing segment, and

wherein a path to ground is provided that extends through each operative component and each tubing segment.

~~23~~19. A method of making an electrostatic discharge mitigation fluid circuit for a predetermined fluid flow passageway, having at least one inlet and at least one outlet comprising:

connecting a plurality of tubing segments to a plurality of operative components, each operative component comprising a body portion with an internal fluid flow passageway and a plurality of tubing connector fittings, the operative components connecting the plurality of tubing segments at selected tubing connector fittings, the plurality of tubing segments and operative components providing the fluid flow passageway through the fluid circuit;

wherein each tubing segment comprises i) a non-conductive polymer portion defining the fluid passageway and ii) an one or more interior conductive stripes of fluoropolymer extending axially to ends of each of the respective tubing segments,

wherein each body portion comprises an conductive fluoropolymer that extends between each of the plurality of tubing connector fittings, and

wherein each of the tubing connector fittings conductively connects the respective conductor of the body portion to ~~the~~ at least one interior conductive fluoropolymer stripe of the tubing segment, and

connecting the electrostatic discharge mitigation fluid circuit to ground.

~~24~~20. The method of making the electrostatic discharge mitigation fluid circuit of claim ~~23~~19, wherein the plurality of operative components includes any one of a valve, a straight connector, a T-connector, an elbow connector, a multi-connector manifold, a filter, a heat exchanger, or a sensor.

~~25. The fluid circuit or method of any one of claims 1-24, wherein the interior conductive stripes of the tubing segments are bonded to and uniform with the non-conductive polymer portion of the tubing segments.~~