CLAIMS

What is claimed is:

1. A method of batch fabricating a plurality of catheter arms for vascular denervation comprising:

depositing a first polymer coating on a semiconductor substrate;

forming metal traces on the first polymer coating;

patterning and etching the substrate to the first polymer coating to create flexible joint regions; and

fabricating the plurality of catheter arms with flexible joint regions.

2. The method in accordance with Claim 1 wherein depositing the first polymer coating on the semiconductor substrate comprises:

anchor trenching the substrate; and

depositing the first polymer coating on the semiconductor substrate including depositing the first polymer coating into the anchor trenches for enhanced adhesion between the first polymer coating and the semiconductor substrate.

3. The method in accordance with Claim 1 wherein depositing the first polymer coating on the semiconductor substrate comprises:

depositing a nitride layer on the semiconductor substrate; and

depositing the first polymer coating on the nitride layer.

4. The method in accordance with Claim 1 wherein forming the metal traces on the first polymer coating comprises:

depositing an oxide layer on the first polymer coating for enhanced adhesion of the metal traces; forming the metal traces on the oxide layer; and

depositing a second polymer coating to cover the metal traces.

5. The method in accordance with Claim 4 wherein depositing the second polymer coating comprises patterning and etching the second polymer coating to expose the metal traces.

6. The method in accordance with Claim 1 wherein patterning and etching the substrate to create the flexible joint regions comprises deep-reactive-ion-etching the semiconductor substrate from the backside such that the flexible joint regions do not comprise any of the semiconductor substrate.

7. The method in accordance with Claim 1 wherein the polymer coating is a patternable polymer material.

8. The method in accordance with Claim 1 wherein the semiconductor substrate is silicon.

9. The method in accordance with Claim 1 wherein the metal traces include one of more of titanium, gold, nickel , copper, chromium, aluminium, indium, platinum, silver and tin.

10. The method in accordance with Claim 1 wherein forming the metal traces comprises forming circuitry on the first polymer coating.

11. The method in accordance with Claim 10 wherein the circuitry comprises one or more metallic gauges for tactile sensing.

12. The method in accordance with Claim 10 wherein the circuitry comprises one or more electrodes for nerve ablation.

13. The method in accordance with Claim 10 wherein the circuitry comprises one or more temperature sensor for the temperature measurement of nerve ablation.

14. A device for vascular denervation comprising:

a catheter for insertion into a vessel;

at least one elongated catheter arm comprising alternating regions of flexible joints and rigid blocks along the at least one catheter arm, wherein each of the at least one elongated catheter arm comprises:

two or more sensors disposed on each of the at least one catheter arm, the two or more sensors comprising at least one tactile sensor and at least one temperature sensor;

at least one electrode disposed on each of the at least one catheter arm for nerve ablation; and

electrical circuitry disposed on each of the at least one catheter arm and coupled to inputs and outputs of the at least one electrode and the at least one sensor; and

at least one linkage connected to all of the at least one elongated catheter arm at substantially an end of the at least one elongated catheter arm for wrapping all of the at least one catheter arm around the catheter, wherein the linkage is formed to have a ring structure and all of the at least one catheter arm are formed radially around the ring structure of the linkage at a first end thereof such that the device is assembled by inserting the catheter through the ring structure and wrapping the at least one catheter arm around the catheter and securing all of the at least one catheter arm to each other at a second end distal to the first end.

15. The device in accordance with Claim 14 wherein each of the at least one catheter arm comprises:

at least five rigid block regions; and

at least four flexible joint regions, each of the at least five rigid block regions being separated from other ones of the at least five rigid block regions by one of the at least four flexible joint regions,

wherein each of the at least one catheter arm bends at each of the at least four flexible joint regions such that at least a central one of the at least five rigid block regions is displaced towards a wall of the vessel into which the device is inserted.

16. The device in accordance with Claim 15 wherein the sensors and electrodes are disposed on one or more of the at least five rigid block regions.

17. The device in accordance with Claim 15 wherein one of the at least one catheter arm has one or more of the at least four flexible joint regions located different lengths from an end thereof with respect to other ones of the at least one catheter arm.

18. The device in accordance with Claim 14 wherein the one or more sensors further comprise radio frequency (RF) electrodes or heaters and/or temperature sensors.

19. The device in accordance with Claim 14 wherein the electrical circuitry comprises at least a multiplexer coupled by the electrical circuitry to outputs of the two or more sensors and/or the at least one electrode for selection and forwarding an output thereof.

20. The device in accordance with Claim 16 wherein each of the at least one tactile sensor disposed on the one or more of the at least five rigid block regions comprises an impedance change element configured to use force and/or pressure sensing to detect contact with the wall of the vessel for nerve ablation at the wall by one of the at least one electrode.

21. The device in accordance with Claim 15 wherein the at least one tactile sensor is configured to detect contact with the wall of the vessel for nerve ablation at the wall in response to an extent of bending of one of the at least four flexible joint regions on which the at least one tactile sensor is disposed.

22. The device in accordance with Claim 21 wherein the at least one tactile sensor comprises an impedance change element, and wherein the at least one impedance change element is configured to detect the contact with the wall of the vessel for nerve ablation at the wall in response to the extent of bending of the one of the at least four flexible joint regions on which the at least one tactile sensor is disposed.

23. The device in accordance with Claim 14 wherein one of the at least one electrode comprises a radio frequency electrode or heater.