CLAIMS

1. A composite structure for a pressure sensor, the composite structure comprising:

an array of microstructures made from an elastomeric material; and

a flexible conductive coating formed on the array of microstructures such that a surface morphology of the array of microstructures is substantially maintained for the coated array of the microstructures;

wherein the conductive coating exhibits a Young's modulus that is higher than that of the elastomeric material;

wherein the flexible conductive coating comprises a low dimensional electronically active material system formed on an intermediate uniform layer between the array of microstructures and the low dimensional electronically active material system; and

wherein the low dimensional electronically active material system exhibits electron tunneling properties.

2. The composite structure of claim 1, wherein the Young's modulus is about one order of magnitude higher than that of the elastomeric material, or more.

3. The composite structure of claims 1 or 2, wherein the low dimensional electronically active material system comprises a uniform layer.

4. The composite structure of any one of claim 1 to 3, wherein the low dimensional electronically active material system comprises 2D material structures.

5. The composite structure of claim 4, wherein the 2D material structures comprise nanoflakes.

6. The composite structure of any one of the preceding claims, further comprising a substrate for the array of microstructures.

7. The composite structure of any one of the preceding claims, further comprising an intermediate layer between the array of microstructures and the flexible conductive coating for improved uniformity of the flexible conductive coating.

8. A pressure sensor comprising the composite structure of any one of the preceding claims.

9. The pressure sensor of claim 8, exhibiting a reduced hysteresis based on elastic properties of the composite structure compared to viscoelastic properties of the elastomeric material of the array of microstructures.

10. The pressure sensor of claims 8 or 9, exhibit a substantially frequency independent pressure response.

11. The pressure sensor of any one of claims 8 to 10, exhibiting a substantially temperature independent pressure response.

12. The pressure sensor of any one of claims 8 to 11, exhibiting a substantially humidity independent pressure response.

13. The pressure sensor of any one of claims 8 to 12, further comprising electrodes disposed on the coated array of microstructures for measuring a resistance of an electric path comprising a portion of a surface of the coated array of microstructures.

14. The pressure sensor of claim 13, wherein the electrodes comprise two interdigital electrodes.

15. The pressure sensor of claims 13 or 14, wherein the resistance changes as a result of compression of the coated array of microstructures under a pressure.

16. The pressure sensor of claim 15, wherein the resistance decreases with increasing pressure.

17. A method of fabricating a composite structure for a pressure sensor, the method comprising the steps of:

forming an array of microstructures made from an elastomeric material; and

forming a flexible conductive coating on the array of microstructures such that a surface morphology of microstructures is substantially maintained for the coated array of the microstructures;

wherein the conductive coating exhibits a Young's modulus that is higher than that of the elastomeric material;

wherein forming the flexible conductive coating comprises forming an intermediate uniform layer on the array of microstructures and providing a low dimensional electronically active material system on the intermediate uniform layer; and

wherein the low dimensional electronically active material system exhibits electron tunneling properties.

18. The method of claim 17, wherein forming the flexible coating comprises drop casting the low dimensional electronically active material system onto the intermediate uniform layer.

19. The method of claim 18, comprising blading the intermediate uniform layer onto the array of microstructures prior to drop casting the low dimensional electronically active material system.

20. The method of any one of claims 17 to 19, wherein the low dimensional electronically active material system comprises a uniform layer.

21. The method of any one of claims 17 to 20, wherein the electronically active material system comprises 2D material structures.

22. The method of claim 21, wherein the 2D material structures comprise nanoflakes.

23. The method of any one of the claims 17 to 22, further comprising disposing electrodes on the coated array of microstructures for measuring a resistance of an electric path comprising a portion of a surface of the coated array of microstructures.

24. A method of pressure sensing using the pressor sensor of any one of claims 8 to 16.