CLAIMS

1. A valve assembly comprising:

a substrate;

an aperture in the substrate including a closure member extending into the aperture;

a flexible fluid pipe disposed between the closure member and a closure edge of the aperture;

a displacement member coupled to the substrate and configured for thermal actuation to displace the closure member so as to vary the cross-sectional profile of the flexible fluid pipe.

2. The valve assembly of claim 1 in which the substrate is a printed circuit board substrate.

3. The valve assembly of claim 1 in which the closure member is a cantilever extending into the aperture.

4. The valve assembly of claim 1 in which the closure member is an axially compressible member extending into the aperture.

5. The valve assembly of claim 1 in which the displacement member is configured for thermal actuation to displace the closure member so as to open and close a lumen of the flexible fluid pipe.

6. The valve assembly of claim 1 in which the displacement member comprises a tension wire connected to and extending between the closure member and a main body of the substrate, the tension wire configured to vary its length as a function of temperature.

7. The valve assembly of claim 6 further including electrically conductive tracks extending along the substrate to the tension wire, to form an electrical connection therewith.

8. The valve assembly of claim 6 or claim 7 in which the tension wire comprises a shape memory alloy.

9. The valve assembly of claim 7 or claim 8 in which the displacement member is configured to shorten in length upon heating by electrical current passing therethrough.

10. The valve assembly of claim 1 further including a nub projecting laterally between the closure member and the closure edge of the aperture, the nub compressing the flexible fluid pipe into a closed or partially closed configuration when the closure member is in an unbiased configuration.

11. The valve assembly of claim 1 configured such that thermal activation of the displacement member biases the closure member away from the closure edge of the aperture such that pressure on the flexible fluid pipe is relieved and the pipe adopts an open configuration.

12. The valve assembly of claim 1 configured such that the displacement of the closure member to vary the cross-sectional profile of the flexible fluid pipe occurs entirely within the plane of the substrate.

13. The valve assembly of claim 12 configured such that movement of the displacement member to displace the closure member occurs entirely within the plane of the substrate.

14. The valve assembly of claim 1 in which the closure member and / or the displacement member is / are recessed below a major surface of the substrate.

15. A fuel cell stack comprising an anode or cathode feed conduit for delivery of fuel or oxidant to cells in the stack, the feed conduit passing through a valve assembly according to any preceding claim disposed within the stack, to control flow of fuel or oxidant to the cells within the stack.

16. The fuel cell stack of claim 15 in which the valve assembly is integrated into a printed circuit board forming a current collector plate of the fuel cell stack.

17. The valve assembly of claim 1 further including a latching mechanism configurable to retain the closure member in its displaced condition independent of the thermal actuation state of the displacement member.

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CLAIMS

1. A valve assembly comprising:

a substrate having a plane;

an aperture in the substrate including a closure member extending into the aperture;

a flexible fluid pipe disposed between the closure member and a closure edge of the aperture;

a displacement member coupled to the substrate and configured for thermal actuation to displace the closure member laterally in the plane of the substrate so as to vary the cross-sectional profile of the flexible fluid pipe.

2. The valve assembly of claim 1 in which the substrate is a printed circuit board substrate.

3. The valve assembly of claim 1 in which the closure member is a cantilever extending into the aperture.

4. The valve assembly of claim 1 in which the closure member is an axially compressible member extending into the aperture.

5. The valve assembly of claim 1 in which the displacement member is configured for thermal actuation to displace the closure member so as to open and close a lumen of the flexible fluid pipe.

6. The valve assembly of claim 1 in which the displacement member comprises a tension wire connected to and extending between the closure member and a main body of the substrate, the tension wire configured to vary its length as a function of temperature.

7. The valve assembly of claim 6 further including electrically conductive tracks extending along the substrate to the tension wire, to form an electrical connection therewith.

8. The valve assembly of claim 6 or claim 7 in which the tension wire comprises a shape memory alloy.

9. The valve assembly of claim 7 or claim 8 in which the displacement member is configured to shorten in length upon heating by electrical current passing therethrough.

10. The valve assembly of claim 1 further including a nub projecting laterally between the closure member and the closure edge of the aperture, the nub compressing the flexible fluid pipe into a closed or partially closed configuration when the closure member is in an unbiased configuration.

11. The valve assembly of claim 1 configured such that thermal activation of the displacement member biases the closure member away from the closure edge of the aperture such that pressure on the flexible fluid pipe is relieved and the pipe adopts an open configuration.

12. The valve assembly of claim 1 configured such that the displacement of the closure member to vary the cross-sectional profile of the flexible fluid pipe occurs entirely within the plane of the substrate.

13. The valve assembly of claim 12 configured such that movement of the displacement member to displace the closure member occurs entirely within the plane of the substrate.

14. The valve assembly of claim 1 in which the closure member and / or the displacement member is / are recessed below a major surface of the substrate.

15. A fuel cell stack comprising an anode or cathode feed conduit for delivery of fuel or oxidant to cells in the stack, the feed conduit passing through a valve assembly according to any preceding claim disposed within the stack, to control flow of fuel or oxidant to the cells within the stack.

16. The fuel cell stack of claim 15 in which the valve assembly is integrated into a printed circuit board forming a current collector plate of the fuel cell stack.

17. The valve assembly of claim 1 further including a latching mechanism configurable to retain the closure member in its displaced condition independent of the thermal actuation state of the displacement member.