CLAIMS

1. A device for synchronized light and sound emission, comprising:

a first electrode layer;

a second electrode layer; and

a composite material layer disposed between the first electrode layer and the second electrode layer, the composite material layer having an electromechanical active matrix and an electroluminescent component; and

wherein the electroluminescent component comprises a plurality of particle sets dispersed in the electromechanical active matrix, each particle set being continuous and having two ends each in contact with a respective one of the first and second electrode layers.

2. The device as claimed in claim 1, wherein at least one of the electrode layers is optically transparent.

3. The device as claimed in claim 1 or 2, wherein at least one of the electrode layers is patterned to form a multi-element array.

4. The device as claimed in any of the preceding claims, wherein the composite material layer is configured to convert an electrical input signal to synchronized light and sound outputs.

5. The device as claimed in claim 4, wherein the electrical input signal comprises an amplitude and a frequency selected to control a sound level and a frequency of the sound output.

6. The device as claimed in claim 5, wherein the amplitude and the frequency of the electrical input signal are selected to control a luminance and a wavelength of the light output.

7. The device as claimed in any of the preceding claims, wherein the electromechanical active matrix comprises a piezoelectric polymer.

8. The device as claimed in claim 7, wherein the piezoelectric polymer comprises poly(vinylidene fluoride) (PVDF) or poly(vinylidene fluoride–trifluoroethylene) (P(VDF-TrFE).

9. The device as claimed in any of the preceding claims, wherein the electroluminescent component comprises an inorganic phosphor.

10. The device as claimed in claim 9, wherein the inorganic phosphor comprises ZnS:Cu or ZnS:Mn.

11. The device as claimed in any of the preceding claims, wherein each of the first electrode layer and the second electrode layer comprises an electrically conductive polymer, a metal or an alloy.

12. The device as claimed in any of the preceding claims, further comprising a transparent substrate disposed adjacent to the first electrode layer or the second electrode layer.

13. The device as claimed in any one of claims 1 to 11, wherein the first electrode layer or the second electrode layer comprises an opaque electrode layer having a reflective surface.

14. The device as claimed in any one of claims 1 to 11, further comprising an opaque substrate disposed adjacent to the first electrode layer or the second electrode layer.

15. The device as claimed in any of the preceding claims, wherein each of the plurality of particle sets has a particle size substantially the same as a thickness of the composite material layer.

16. The device as claimed in any of the preceding claims, wherein the electroluminescent component is continuous in a direction that is substantially perpendicular to the first and second electrode layers.

17. An alarm comprising the device as claimed in any of the preceding claims.

18. A method for synchronized light and sound emission, comprising:
providing a device as claimed in any of claims 1 to 16; and

applying an electrical input signal to generate synchronized light and sound outputs.

19. The method as claimed in claim 18, wherein applying an electrical input signal comprises applying an alternating current (AC) electric field across the composite material layer.

20. The method as claimed in claim 18 or 19, wherein applying the electrical input signal comprises selecting an amplitude and a frequency of the electrical input signal to control a sound level and a frequency of the sound output.

21. The method as claimed in claim 20, wherein applying the electrical input signal further comprises selecting the amplitude and the frequency of the electrical input signal to control a luminance and a wavelength of the light output.