CLAIMS

1. A nanogap electrode device comprising,

a first electrode and a second electrode spaced apart from each other, said first and second electrodes defining a first region and a second region;

wherein the first and second electrodes each comprises a continuous length of material arranged to form a plurality of horizontal members and a plurality of lateral members;

wherein each one of the plurality of horizontal members of the first electrode has a corresponding horizontal member of the second electrode which is substantially parallel to each other, and each horizontal member comprises a first end and a second end; and

wherein the plurality of lateral members is orthogonally arranged with respect to the plurality of horizontal members, and each lateral member either connects the first ends of two adjacent horizontal members or the second ends of two adjacent horizontal members;

wherein the first region comprises a first gap between the first electrode and the second electrode, said first gap having a first gap length and a first gap width;

wherein the second region comprises a second gap between the first electrode and the second electrode, said second gap having a second gap length and a second gap width; and

wherein the second gap length and second gap width are greater than the first gap width.

2. The nanogap electrode device according to claim 1, wherein the second gap width is greater than the first gap width by a factor of from 3.75 to 60.

3. The nanogap electrode device according to claim 1 or 2, wherein the first gap width falls in a range of from 50 nm to 400 nm, and the second gap width falls in a range of from 1500 nm to 3000 nm.

4. The nanogap electrode device according to any one of claims 1 to 3, wherein the first gap length falls in a range of from 600 nm to 1000 nm, and the second gap length falls in a range of from 500 nm to 900 nm.

5. The nanogap electrode device according to any one of claims 1 to 4, further comprising a plurality of alternating first and second regions defined by the first and second electrodes.

6. The nanogap electrode device according to any one of claims 1 to 5, wherein the first region comprises a sensing region having an area defined by the first gap length and the first gap width.

7. The nanogap electrode device according to any one of claims 1 to 6, wherein the second region comprises a reservoir region having an area defined by the second gap length and the second gap width.

8. The nanogap electrode device according to any one of claims 1 to 7, further comprising

a surface modification layer substantially uniformly disposed on the first and second electrodes; and

a layer of biomolecules substantially uniformly disposed on the surface modification layer.

9. The nanogap electrode device according to any one of claims 1 to 8, wherein a joint section of the horizontal member and lateral member at an inlet to the first region comprises either an angular edge or a curved edge.

10. The nanogap electrode device according to any one of claims 1 to 9, wherein the horizontal member has a length falling in a range of from 400 nm to 1200 nm, and the lateral member has a length falling in a range of from 600 nm to 1400 nm.

11. A method of making a nanogap electrode device, the method comprising,

providing a first electrode and a second electrode spaced apart from each other, said first and second electrodes defining a first region and a second region,

wherein providing the first and second electrodes comprises providing a continuous length of material for each of the first and second electrodes, said continuous length of material arranged to form a plurality of horizontal members and a plurality of lateral members;

wherein each one of the plurality of horizontal members of the first electrode has a corresponding horizontal member of the second electrode which is substantially parallel to each other, and each horizontal member comprises a first end and a second end; and

wherein the plurality of lateral members is orthogonally arranged with respect to the plurality of horizontal members, and each lateral member either connects the first ends of two adjacent horizontal members or the second ends of two adjacent horizontal members;

forming a first gap between the first electrode and the second electrode in the first region, said first gap having a first gap length and a first gap width;

forming a second gap between the first electrode and the second electrode in the second region, said second gap having a second gap length and a second gap width;

wherein the second gap length and second gap width are greater than the first gap width.

12. The method according to claim 11, wherein the second gap width is greater than the first gap width by a factor of from 3.75 to 60.

13. The method according to claim 11 or 12, wherein the first gap width falls in a range of from 50 nm to 400 nm, and the second gap width falls in a range of from 1500 nm to 3000 nm.

14. The method according to any one of claims 11 to 13, wherein the first gap length falls within a range of from 600 nm to 1000 nm, and the second gap length falls within a range of from 500 nm to 900 nm.

15. The method according to any one of claims 11 to 14, further comprising providing a plurality of alternating first and second regions defined by the first and second electrodes.

16. The method according to any one of claims 11 to 15, wherein providing the first and second electrodes comprises forming a sensing region having an area defined by the first gap length and the first gap width.

17. The method according to any one of claims 11 to 16, wherein providing the first and second electrodes comprises forming a reservoir region having an area defined by the second gap length and the second gap width.

18. The method according to any one of claims 11 to 17, further comprising

providing a surface modification layer substantially uniformly disposed on the first and second electrodes; and

providing a layer of biomolecules substantially uniformly disposed on the surface modification layer.

19. The method according to any one of claims 11 to 18, wherein a joint section of the horizontal member and lateral member at an inlet to the first region comprises either an angular edge or a curved edge.

20. The method according to any one of claims 11 to 19, wherein the horizontal member has a length falling in a range of from 400 nm to 1200 nm, and the lateral member has a length falling in a range of from 600 nm to 1400 nm.

21. A sensor for detecting a target analyte, said sensor comprising,

a nanogap electrode device comprising,

a first electrode and a second electrode spaced apart from each other, said first and second electrodes defining a first region and a second region;

wherein the first and second electrodes each comprises a continuous length of material arranged to form a plurality of horizontal members and a plurality of lateral members;

wherein each one of the plurality of horizontal members of the first electrode has a corresponding horizontal member of the second electrode which is substantially parallel to each other, and each horizontal member comprises a first end and a second end; and

wherein the plurality of lateral members is orthogonally arranged with respect to the plurality of horizontal members, and each lateral member either connects the first ends of two adjacent horizontal members or the second ends of two adjacent horizontal members;

wherein the first region comprises a first gap between the first electrode and the second electrode, said first gap having a first gap length and a first gap width;

wherein the second region comprises a second gap between the first electrode and the second electrode, said second gap having a second gap length and a second gap width; and

wherein the second gap length and second gap width are greater than the first gap width.