Claims

What is claimed is:

1. 1. A method of determining/adjusting the sensitivity of a biosensor arrangement comprising at least one field effect biosensor, each of the at least one field effect biosensor comprising:

- a semiconductor substrate comprising a source region, a drain region and a channel region disposed between the source region and the drain region;
- a gate isolation layer covering the channel region; and
- a reference electrode disposed over the gate isolation layer such that a electrolytic solution to be sensed can be provided between the reference electrode and the gate isolation layer,

the method comprising the following processes carried out for each field effect biosensor:

- providing an electrolytic solution between the reference electrode and the gate isolation layer;
- applying a source/drain voltage between the source region and the drain region;
- varying a reference voltage supplied to the reference electrode over a voltage range;
- measuring a resulting drain current while varying the reference voltage in order to obtain a corresponding drain current function; and
- determining the sensitivity of the field effect biosensor based on the reference voltage supplied to the refernce electrode and the corresonding drain current function.

2. The method according to claim 1,

wherein determining the sensitivity of a field effect biosensor comprises:

- determining an effective transconductance function by differentiating the measured drain current function with respect to the reference voltage supplied;
- dividing the determined effective transconductance function by the measured drain current function.

3. The method according to any one of the claims 1 or 2,

further comprising comparing the sensitivities of the different field effect biosensors among each other, wherein a normalization process is carried out in which an avarage sensitivity for all of the field effect biosensors is calculated.

4. The method according to any one of the claims 1 to 3,

further comprising shifting the working point of each field effect biosensor into a region of maximum sensitivity.

5. The method according to any one of the claims 1 to 3,

further comprising shifting the working point of each field effect biosensor into a region of increased sensitivity in which the sensitivity is not maximum, in which however the drain current would still be large enough to yield reliable measurement results.

6. The method according to any one of the claims 1 to 5,

further comprising comparing the sensitivities of the field effect biosensors among each other, wherein biosensors showing a sensitivity falling below a first threshold value or exceeding a second threshold value are disabled.

7. A biosensor sensitivity determining system for determining/adjusting the senitivity of a biosensor arrangement comprising at least one field effect biosensor, each of the at least one field effect biosensor comprising:

- a semiconductor substrate comprising a source region, a drain region and a channel region disposed between the source region and the drain region;
- a gate isolation layer covering the channel region; and
- a reference electrode disposed over the gate isolation layer such that a electrolytic solution to be sensed can be provided between the reference electrode and the gate isolation layer,

the biosensor sensitivity determining system comprising the following fuctional units for each of the field effect biosensors:

- a source/drain voltage applying unit adapted to apply a source/drain voltage between the source region and the drain region;
- a reference voltage applying unit adapted to apply a varying reference voltage which varies over a predetermined voltage range to the reference electrode;
- a drain current measuring unit adapted to measure a drain current resulting when varying the reference voltage in order to obtain a corresponding drain current function; and

- a sensitivity determining unit adapted to determine the sensitivity based on the reference voltage supplied to the corresponding reference electrode and the corresonding drain current function.

8. The biosensor sensitivity determining system according to claim 7, wherein the sensitivity determining unit is further adapted to:

- determine an effective transconductance function by differentiating the measured drain current function with respect to reference voltage supplied to the reference electrode;
- dividing the determined effective transconductance function by the measured drain current function.

9. The biosensor sensitivity determining system according to any one of the claims 7 or 8, further comprising a processing unit adapted to compare the sensitivities of the field effect biosensors among each other, wherein a normalization process is carried out in which an avarage sensitivity for all of the field effect biosensors is calculated.

10. The biosensor sensitivity determining system according to any one of the claims 7 to 9, further comprising a calibration unit adapted to shift the working point of each field effect biosensor into a region of maximum sensitivity.

11. The biosensor sensitivity determining system according to any one of the claims 7 to 9,

further comprising a calibration unit adapted to shift the working point of each field effect biosensor into a region of increased sensitivity in which the sensitivity is not maximum, in which however the drain current would still be large enough to yield reliable measurement results.

12. The biosensor sensitivity determining system according to any one of the claims 7 to 11, further comprising a disabling unit adapted to compare the sensitivities of the field effect biosensors among each other, wherein biosensors showing a sensitivity falling below a first threshold value or exceeding a second threshold value are disabled.

Claims

What is claimed is:

1. A method of determining/adjusting the sensitivity of a biosensor arrangement comprising at least one field effect biosensor, each of the at least one field effect biosensor comprising:

- a semiconductor substrate comprising a source region, a drain region and a channel region disposed between the source region and the drain region;

- a gate isolation layer covering the channel region; and

- a reference electrode disposed over the gate isolation layer such that a electrolytic solution to be sensed can be provided between the reference electrode and the gate isolation layer, the method comprising the following processes carried out for each field effect biosensor: providing an electrolytic solution between the reference electrode and the gate isolation layer;

- applying a source/drain voltage between the source region and the drain region; varying a reference voltage supplied to the reference electrode over a voltage range;

- measuring a resulting drain current while varying the reference voltage in order to obtain a corresponding drain current function; and

- determining the sensitivity of the field effect biosensor based on the reference voltage supplied to the reference electrode and the corresponding drain current function, wherein determining the sensitivity of the field effect biosensor comprises determining an effective transconductance function by differentiating the measured drain current function with respect to the reference voltage supplied, and dividing the determined effective transconductance function by the measured drain current function.

2. The method according to claim 1, further comprising comparing the sensitivities of the different field effect biosensors among each other, wherein a normalization process is carried out in which an average sensitivity for all of the field effect biosensors is calculated.

3. The method according to claim 1, further comprising shifting the working point of each field effect biosensor into a region of maximum sensitivity.

4. The method according to claim 1, further comprising shifting the working point of each field effect biosensor into a region of increased sensitivity in which the sensitivity is not maximum, in which however the drain current would still be large enough to yield reliable measurement results.

5. The method according to claim 1, further comprising comparing the sensitivities of the field effect biosensors among each other, wherein biosensors showing a sensitivity falling below a first threshold value or exceeding a second threshold value are disabled.

6. A biosensor sensitivity determining system for determining/adjusting the sensitivity of a biosensor arrangement comprising at least one field effect biosensor, each of the at least one field effect biosensor comprising: a semiconductor substrate comprising a source region, a drain region and a channel region disposed between the source region and the drain region;

- a gate isolation layer covering the channel region; and a reference electrode disposed over the gate isolation layer such that a electrolytic solution to be sensed can be provided between the reference electrode and the gate isolation layer, the biosensor sensitivity determining system comprising the following functional units for each of the field effect biosensors: a source/drain voltage applying unit adapted to apply a source/drain voltage between the source region and the drain region;

- a reference voltage applying unit adapted to apply a varying reference voltage which varies over a predetermined voltage range to the reference electrode;

- a drain current measuring unit adapted to measure a drain current resulting when varying the reference voltage in order to obtain a corresponding drain current function; and a sensitivity determining unit adapted to determine the sensitivity based on the reference voltage supplied to the corresponding reference electrode and the corresponding drain current function, wherein the sensitivity determining unit is further adapted to determine an effective transconductance function by differentiating the measured drain current function with respect to reference voltage supplied to the reference electrode, and divide the determined effective transconductance function by the measured drain current function.

7. The biosensor sensitivity determining system according to claim 6, further comprising a processing unit adapted to compare the sensitivities of the field effect biosensors among each other, wherein a normalization process is carried out in which an average sensitivity for all of the field effect biosensors is calculated.

8. The biosensor sensitivity determining system according to claim 6, further comprising a calibration unit adapted to shift the working point of each field effect biosensor into a region of maximum sensitivity.

9. The biosensor sensitivity determining system according to claim 6, further comprising a calibration unit adapted to shift the working point of each field effect biosensor into a region of increased sensitivity in which the sensitivity is

not maximum, in which however the drain current would still be large enough to yield reliable measurement results.

10. The biosensor sensitivity determining system according to claim 6, further comprising a disabling unit adapted to compare the sensitivities of the field effect biosensors among each other, wherein biosensors showing a sensitivity falling below a first threshold value or exceeding a second threshold value are disabled.

11. A method of determining/adjusting the sensitivity of a biosensor arrangement comprising at least one biosensor, each of the at least one biosensor comprising: a semiconductor substrate comprising a source region and a drain region;

- an isolation layer covering a region between the source region and the drain region; and a reference electrode disposed over the isolation layer such that a electrolytic solution to be sensed can be provided between the reference electrode and the isolation layer, the method comprising the following processes carried out for each biosensor: providing an electrolytic solution between the reference electrode and the isolation layer;

- applying a source/drain voltage between the source region and the drain region;

- varying a reference voltage supplied to the reference electrode over a voltage range;

- measuring a resulting drain current while varying the reference voltage in order to obtain a corresponding drain current function; and

- determining the sensitivity of the biosensor based on the reference voltage supplied to the reference electrode and the corresponding drain current function, wherein determining the sensitivity of the biosensor comprises determining an effective transconductance function by differentiating the measured drain current function with respect to the reference voltage supplied, and dividing the determined effective transconductance function by the measured drain current function.

12. The method according to claim 11, further comprising at least one nanowire extends between the source region and the drain region.

13. The method according to claim 12, wherein the isolation layer isolates the at least one nanowire from the substrate.

14. A biosensor sensitivity determining system for determining/adjusting the sensitivity of a biosensor arrangement comprising at least one biosensor, each of the at least one biosensor comprising: a semiconductor substrate comprising a source region and a drain region;

- an isolation layer covering a region between the source region and the drain region; and

- a reference electrode disposed over the isolation layer such that a electrolytic solution to be sensed can be provided between the reference electrode and the isolation layer, the biosensor sensitivity determining system comprising the following functional units for each of the biosensors: a source/drain voltage applying unit adapted to apply a source/drain voltage between the source region and the drain region;

- a reference voltage applying unit adapted to apply a varying reference voltage which varies over a predetermined voltage range to the reference electrode;

- a drain current measuring unit adapted to measure a drain current resulting when varying the reference voltage in order to obtain a corresponding drain current function; and a sensitivity determining unit adapted to determine the sensitivity based on the reference voltage supplied to the corresponding reference electrode and the corresponding drain current function, wherein the sensitivity determining unit is further adapted to determine an effective transconductance function by differentiating the measured drain current function with respect to reference voltage supplied to the reference electrode, and divide the determined effective transconductance function by the measured drain current function.

15. The biosensor sensitivity determining system according to claim 14, further comprising at least one nanowire extends between the source region and the drain region.

16. The biosensor sensitivity determining system according to claim 15, wherein the isolation layer isolates the at least one nanowire from the substrate.