In a first aspect of the present invention, a method for determining an analyte concentration in a fluid using an analyte sensor, wherein the analyte sensor comprises at least two measurement electrodes, wherein at least one of the measurement electrodes comprises an analyte-responsive polymer gel, is provided. The method comprises the following steps:

a) contacting at least the analyte-responsive polymer gel of the analyte sensor with the fluid comprising the analyte;

b) generating at least one fast-transient voltage signal and applying the fast-transient voltage signal to the measurement electrodes;

c) measuring at least one response signal;

d) determining the analyte concentration by evaluating the response signal,

wherein the fast-transient voltage signal comprises a non-continuous signal.

The term "analyte" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to an arbitrary element, component or compound which may be present in a fluid, specifically in a bodily fluid, and the concentration of which may be of interest for a user. Specifically, the analyte may be or may comprise an arbitrary chemical substance or chemical compound which may take part in the metabolism of the user, such as at least one metabolite. As an example, the at least one analyte may be selected from the group consisting of glucose, cholesterol, triglycerides, lactate. Specifically, the analyte may be glucose. Additionally or alternatively, however, other types of analytes may be determined and/or any combination of analytes may be determined.

The term "fluid" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to all fluids of interest known to comprise or suspected to comprise the analyte. The fluid may be an electrolyte of a galvanic cell as will be described in more detail below. Specifically, the fluid may be a bodily fluid. The term "bodily fluid" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art and is not to be limited to a special or customized meaning. The term specifically may refer, without limitation, to all bodily fluids of a user known to comprise or suspected to comprise the analyte of the present invention, including interstitial fluid, blood, plasma, lacrimal fluid, urine, lymph, cerebrospinal fluid, bile, stool, sweat, and saliva. Generally, an arbitrary type of bodily fluid

may be used. Preferably, the bodily fluid is a bodily fluid which is present in a body tissue of a user, such as in the interstitial tissue. Thus, as an example, the bodily fluid may be selected from the group consisting of blood and interstitial fluid. However, additionally or alternatively, one or more other types of bodily fluids may be used. The bodily fluid generally may be contained in a body tissue. Thus, generally, the detection of the at least one analyte in the bodily fluid may preferably be determined *in vivo*. However, other non-in vivo applications are possible.

The term "determining a concentration of at least one analyte" as used herein is a broad term and is to be given its ordinary and customary meaning to a person of ordinary skill in the art

in particular method steps b) to d), according to one of the embodiments described in this description, if the program code means are executed on a computer or on a computer network.

In a further aspect of the present invention, there is provided an analytical system for determining a concentration of at least one analyte in a fluid, wherein the analytical system comprises at least one analyte sensor, wherein the analyte sensor comprises at least two measurement electrodes, wherein at least one of the measurement electrodes comprises an analyte-responsive polymer gel, wherein the analytical system comprises at least one signal generator device configured for generating at least one fast-transient voltage signal, wherein the signal generator device is configured for applying the fast-transient voltage signal to the two measurement electrodes, wherein the analytical system comprises at least one measurement unit configured for measuring at least one response signal, wherein the analytical system comprises at least one evaluation device, wherein the evaluation device is configured for determining the analyte concentration by evaluating of the response signal.

As further used herein, the term “system” refers to an arbitrary set of interacting or interdependent component parts forming a whole. Specifically, the components may interact with each other in order to fulfill at least one common function. The at least two components may be handled independently or may be coupled or connectable. Thus, the term “analytical system” generally refers to a group of at least two elements or components which are capable of interacting in order to perform at least one analytical detection, specifically at least one analytical detection of at least one analyte of the sample. The analytical system may be an apparatus, specifically comprising at least two components.

The analytical system comprises at least one analyte sensor. The analyte sensor comprises at least two measurement electrodes, wherein at least one of the measurement electrodes comprises an analyte-responsive polymer gel. The analytical system comprises at least one signal generator device configured for generating at least one fast-transient voltage signal. The signal generator device is configured for applying the fast-transient voltage signal to the two measurement electrodes. The analytical system comprises at least one measurement unit configured for measuring at least one response signal. The analytical system comprises at least one evaluation device, wherein the evaluation device is configured for determining the analyte concentration by evaluating of the response signal.

The term “measurement unit”, also denoted as measurement electronics, generally may refer to an arbitrary device, preferably an electronic device, which may be configured to detect at least one signal, in particular the response signal. The measurement unit may be configured for measuring the response signal generated in response to fast-transient voltage signal. The measurement unit may be configured for receiving the response signal and the current at the counter electrode at the same time or at at least two different time points.

The analyte sensor may be a two electrode sensor. The analyte sensor may comprise a reference resistance in series with an ionic resistivity of the analyte-responsive polymer gel.

Claims

1. A method for determining an analyte concentration in a fluid using an analyte sensor, wherein the analyte sensor comprises at least two measurement electrodes, wherein at least one of the measurement electrodes comprises an analyte-responsive polymer gel, the method comprising the following steps:
   a) contacting at least the analyte-responsive polymer gel of the analyte sensor with the fluid comprising the analyte;
   b) generating at least one fast-transient voltage signal and applying the fast-transient voltage signal to the measurement electrodes;
   c) measuring at least one response signal;
   d) determining the analyte concentration by evaluating the response signal,
   wherein the fast-transient voltage signal comprises a non-continuous signal.

2. The method according to claim 1, wherein evaluating the response signal comprises determining equivalent series resistance of the analyte sensor.

3. The method according to any one of claims 1 or 2, wherein the analyte sensor comprises a reference resistance in series with an ionic resistivity of the analyte-responsive polymer gel.

4. The method according to any one of claims 1 to 3, wherein the analyte-responsive polymer gel comprises a phenylborate.

5. The method according to any one of claims 1 to 4, wherein the analyte-responsive polymer gel comprises Poly(N-isopropylacryl-amide).

6. The method according to any one of claims 1 to 5, wherein the analyte is glucose.

7. The method according to any one of claims 1 to 6, wherein the analyte sensor is a two electrode sensor.

8. The method according to any one of claims 1 to 7, wherein the analyte sensor is placed in vivo to carry out step a).

9. The method according to any one of claims 1 to 8, wherein the fast-transient voltage signal has a square waveform or a sine wave signal form.

10. The method according to any one of claims 1 to 9, wherein the fast-transient voltage signal comprises a pulse, wherein a pulse duration is ≤ 20 µs, preferably ≤ 10 µs.

11. A computer program comprising program means for performing the method according to any one of claims 1 to 10 while the computer program is being executed on a computer or on a computer network.

12. An analytical system for determining a concentration of at least one analyte in a fluid, wherein the analytical system comprises at least one analyte sensor, wherein the analyte sensor comprises at least two measurement electrodes, wherein at least one of the measurement electrodes comprises an analyte-responsive polymer gel, wherein the analytical system comprises at least one signal generator device configured for generating at least one fast-transient voltage signal, wherein the signal generator device is configured for applying the fast-transient voltage signal to the two measurement electrodes, wherein the analytical system comprises at least one measurement unit configured for measuring at least one response signal, wherein the analytical system comprises at least one evaluation device, wherein the evaluation device is configured for determining the analyte concentration by evaluating of the response signal.

13. The analytical system according to claim 12, wherein the analyte sensor comprises a reference resistance in series with an ionic resistivity of the analyte-responsive polymer gel.

14. The analytical system according to any one of claims 12 or 13, wherein the analyte-responsive polymer gel comprises a phenylborate, and/or wherein the analyte-responsive polymer gel comprises Poly(N-isopropylacryl-amide).

15. The analytical system according to any one of claims 12 to 14, wherein the analytical system is configured for performing the method according to any one of claims 1 to 10.