In this process, an electrical current is generated as measuring signal whose amplitude correlates to the analyte concentration. These types of sensors are also called electrochemical sensors.

US9895091B2 discloses electrochemical sensors. These electrochemical sensors can comprise an impermeable dielectric layer on top of Ag/AgCl of a reference electrode. This coating is used to extend the reference electrode's lifetime. The electrochemical sensor disclosed has a layered structure wherein the reference electrode is positioned on top of a working electrode. The working electrode is separated from the reference electrode by an insulating layer.

US10470691B2 discloses an analyte sensor which comprises a working electrode and a reference electrode. The sensor may comprise an insulator formed of an insulating material. A portion of the insulator may be removed to expose the working electrode and/or the reference electrode.

The manufacturing of the sensors disclosed in the prior art is very time- and cost-consuming. Further, they have drawbacks with regard to their long-term stability.

Problem to be solved

It is therefore an object of the present invention to provide an analyte sensor which avoids at least in part certain drawbacks of the prior art, in particular with regard to its manufacturability and also with regard to its long-term stability.

Summary

This problem is solved by an analyte sensor according to the disclosure as well as by the method for manufacturing this sensor according to the disclosure and by the analyte sensor system according to the disclosure. Preferred examples of the disclosure which may be realized in an isolated way or in any arbitrary combination are disclosed in the dependent claims and throughout the specification.

In one aspect, the present disclosure provides an analyte sensor comprising

- a substrate comprising a first side and a second side;
- at least one working electrode positioned on the first side of the substrate, the at least one working electrode comprising:
    - at least one electrically conductive material and
    - at least one enzyme;

- at least one second electrode positioned on the second side of the substrate, the at least one second electrode comprising silver;
- a membrane comprising a polymer composition which comprises a hydrophobic polymer,

wherein the membrane is located on top of the at least one second electrode, wherein the membrane comprises holes, wherein the total area of holes has a size of at most 0.15 mm2.

In another aspect, the present disclosure provides a method for manufacturing an analyte sensor, the method comprising the steps:

a) providing a raw substrate which comprises a first side and a second side,

b) preparing a working electrode region on the first side of the raw substrate, the preparing of the working electrode region comprising the steps:

b1) applying an electrically conductive material to the first side of the raw substrate,

b2) applying a sensing material comprising at least one enzyme at least partially on the electrically conductive material,

c) preparing a second electrode region on the second side of the raw substrate, the preparing of the second electrode region comprising the steps:

c1) applying a silver composition on the second side of the raw substrate,

d) applying a polymer composition on top of the second electrode region, to obtain a membrane, wherein the polymer composition comprises a hydrophobic polymer,

e) cutting the raw substrate comprising the working electrode region, the second electrode region and the membrane to obtain the analyte sensor.

In another aspect, the present disclosure provides an analyte sensor obtainable by a method as described herein.

In another aspect, the present disclosure provides an analyte sensor system comprising

- an analyte sensor as described herein,
- an electronics unit, the electronics unit being configured to electronically connect to the analyte sensor.

The inventive analyte sensor is particularly easy to manufacture. It furthermore exhibits an excellent long-term stability and a stable sensitivity. In particular, the inventive analyte sensor allows the analyte sensor to comprise only two electrodes instead of three, which makes the inventive analyte sensor particularly cost-efficient. Further, it has an improved biocompatibility.

As used in the following, the terms “have”, “comprise”, or “include” or any arbitrary grammatical variations thereof are used in an exclusive way. Thus, these terms may both refer to a situation in