

Biosensor Platform Technology for Ion Concentration Measurement

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⇒ A small, cheap real-time ion concentration measuring sensor platform with a disposable ion reaction channel and a structure for differential/single detection and amplification/offset compensation

Client / Market

- Sensor and measurement device-related company in the medical, bio field (products requiring a cheap, small ion concentration measurement device)
- Soil, water, food, beverage quality management-related company
- Environment monitoring company for chemical product, oil and gas, waste and water treatment facility

Necessity of this Technology

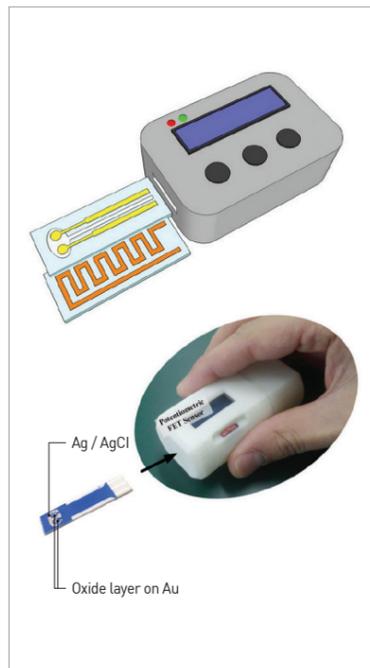
- Existing semiconductor-based ion concentration detection device uses an expensive sensor and has limits regarding its application for a disposable device.
- Offset that occur while acquiring electrochemical reaction voltage lowers the accuracy of the detection and reduces the dynamic range available for detection.
- Need a low-price semiconductor-based sensor platform with a separate reaction channel and a readout circuit for a one-time use
- Need a method to effectively acquire differential signals to detect the real-time change in the ion concentration
- Need a technology to automatically compensate for offset and adjust the amplification level

Technical Differentiation

- With a separated reaction channel from the readout circuit, it is possible to use for disposable device.
- Multiple independent transistors enhance the sensitivity in the detection of the membrane potential.
- Can detect minute motion and change of ions and within a space with a specific amount of ions
- Can selectively detect the differential/single signal
- Offset it automatically compensated while detecting the differential signal to enhance accuracy and expand the dynamic range.
- Can enhance sensitivity by adjusting the amplification level of the differential signal

Excellence of Technology

- Improved the dynamic range available for detection by 22.5 dB (=20 log[Vw/comp/Vw/o comp]) using the automatic offset compensating feedback structure



DESIRED PARTNERSHIP

Technology Transfer

Licensing

Joint Research

Other



TECHNOLOGY READINESS LEVEL [TRL]

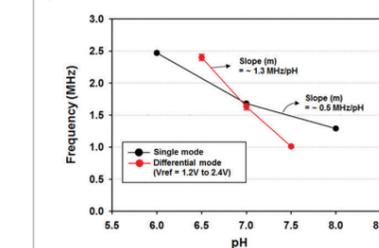
Research, basic explanation | Project concept or idea development | Technology idea verification | Prototype development | Trial product production/evaluation in similar environment | Pilot field demonstration | Development and optimization of commercial model | Commercial product demonstration | Mass production and initial market launch

- The single and differential signal excellently detects target by ion concentration; Especially for the differential mode, by the offset automatic compensation, the same result is obtained regardless of the fluctuation of the reference voltage (1.2 V to 2.4 V).
- The first small module to achieve detection by concentration in the DNA PCR (polymerase chain reaction) experiment

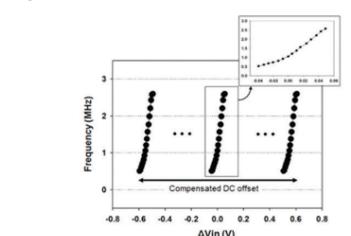
Ion Concentration Measurement Module Prototype



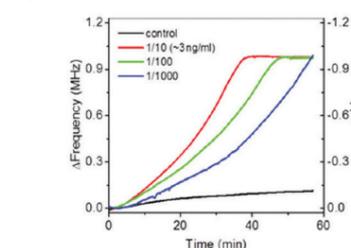
Sensitivity of Detection by Hydrogen Ion Concentration



Improvement Effect of Dynamic Range for Detection



Real-time Result for DNA PCR by Concentration



Current Intellectual Property Right Status

PATENT

- Method and Apparatus for Detecting Ion Concentration (KR1729685, US14/959, 001)
- Differential Amplifier with Offset Correction Ability and Driving Method of the Same (KR2018-0018123)

KNOW-HOW

- Analog circuit design and module fabrication for electrical differential signal detection
- Real-time feedback control technology with automatic offset compensation
- Reactive electrode fabrication for ion detection
- Small device fabrication technology for point-of-care