

# APPLICATION NOTE

# LD20-06



## Measuring trace O<sub>2</sub>-N<sub>2</sub>-H<sub>2</sub>O for Lithium-Ion batteries inert atmosphere



▲ LD8000

▲ PlasmaDetek2  
N<sub>2</sub>

▲ Senz-Tx  
O<sub>2</sub>

▲ Easidew  
H<sub>2</sub>O

### APPLICATION:

Batteries are used to convert electrical energy into a storable chemical energy in order to subsequently release the energy back as electricity at a later point in time. There is a continual race to increase the energy packed into batteries to improve their operability, broaden their range of applications and reduce their manufacturing cost.

They are miniaturised to house watches or implanted medical devices and are used on portable equipment such as smartphones, laptops and power tools. They are also found in communication devices such as satellites, emergency power such as UPS, robotics and heavy machinery. Their usage is gaining tremendous traction in the transport industry and fuel cells applications. They have more recently received a keen interest on the storage of renewable energies from wind and solar power to buffer electrical grid demands.

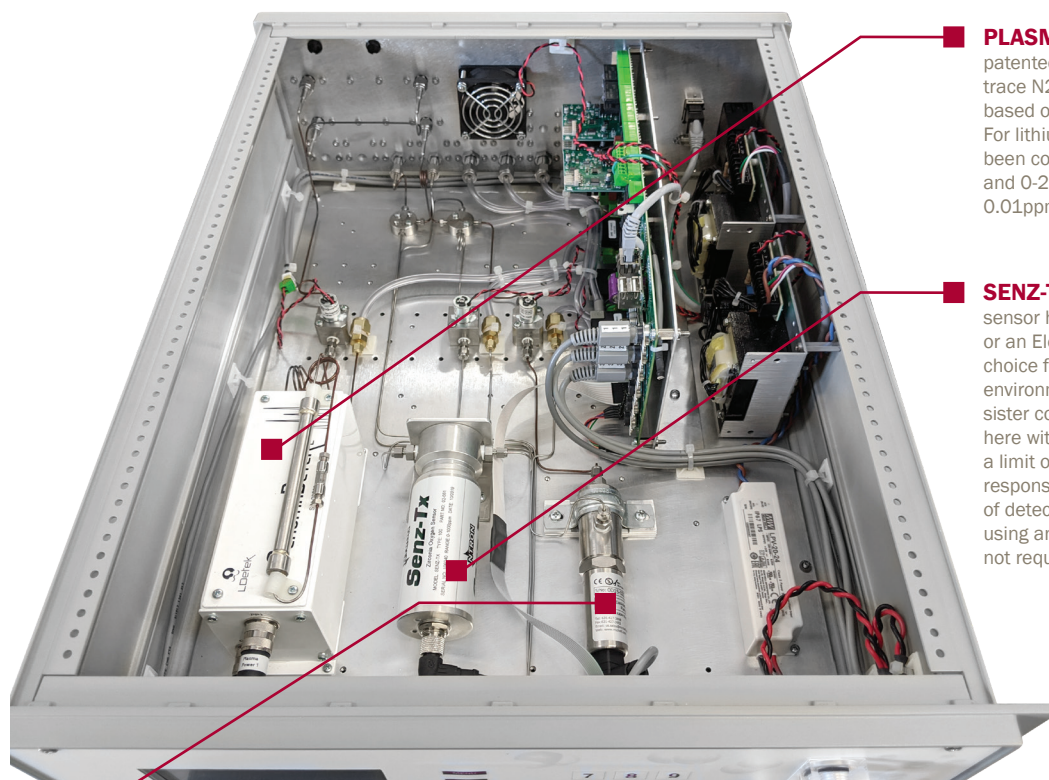
The production of lithium-ion battery cell consists of three main steps: Electrode manufacturing, cell assembly and cell finishing. High-temperature atmospheres are used for sintering of the precursors, inerting atmospheres, and the welding of cell tabs into a stack. Precisely controlled argon or helium atmospheres are typically used to prevent lithium from reacting with oxygen and nitrogen from an air atmosphere. Their presence would result in irreversible damage to the Lithium electrode by the formation of an oxide and a nitride.

The inerting argon atmosphere must equally remain moisture free to prevent it from reacting with the lithium-ion battery electrolyte to form hydrofluoric acid. The electrolyte decomposition rate increases at elevated temperatures, so the overall manufacturing process must be kept under dry conditions. When sealed inside the cell this strong acid can potentially cause short circuits and, in some cases, fire. Moisture emissions from the personnel must also be removed by dry air which is being continuously and accurately delivered to the production area, to prevent the electrolyte to chemically decompose.

Nitrogen, oxygen and water vapour must be kept at the trace ppm level to satisfy the best of industry standard. The LD8000 MultiGas online analyzer from LDetek is the ideal tool to control the atmosphere quality, as it combines the sensing technologies for each of these impurities in a single 3U or 4U rackmount chassis.

Nitrogen impurities are measured in a continuous gas stream using LDetek's patented Plasma Emission Detector (PED). By combining it with trace oxygen measurements using Ntron's Senz-Tx along with Michell Instruments' sensing technologies for moisture measurement, the MultiGas is a staple product to the industry which embodies the synergies of between PST entities. Michell Instruments also offers the precise chilled mirror technology in the S8000 product series for the water dew point measurement of the inerting gas or the dry room environments, with traceability to national metrological standards.

## SOLUTION:



### PLASMADETEK2

patented sensor for detecting ppb/ppm trace N<sub>2</sub> in inert environment. Technology based on its selective spectral emission. For lithium-ion application, the ranges have been configured at 0-200ppm, 0-20ppm and 0-2ppm with a limit of detection at 0.01ppm.

### SENZ-TX

sensor having a choice between a Zirconia or an Electrochemical O<sub>2</sub> cell is the ideal choice for measuring trace O<sub>2</sub> in inert environment. This technology from our sister company NTRON has been configured here with a 0-20ppm, 0-200ppm range with a limit of detection at 0.5ppm using a fast response time zirconia sensor. A lower limit of detection of 0.1ppm can be achieved using an electrochemical sensor, but it was not required here.

### EASIDEW

advanced ceramic moisture sensor technology-based hygrometers from our another sister company Michell has been used for the detection of trace moisture impurity. Configured here for measuring 0-20ppm, 0-200ppm, the sensor offers the required range for the application with a limit of detection being at 0.5ppm. In case of lower limit of detection requirement, the chilled mirror or the quartz crystal technologies can be used as well.

All the 3 sensors run in parallel having each an individual electronic flow controller to regulate the flow rate in a range of 100-200sccm for each sensor. On the front of the unit, a sample bypass purge rotameter is mounted to adjust the desired excess flow for adequate purging of the gas line upfront the instrument between 0-1LPM. All the internal flow path have been reduced to 1/16"OD coated stainless steel tubing to offer the best response time by keeping at minimum the surface volume. The coated tubing ensures to eliminate the surface absorption.

All the data are transmitted by an individual 4-20mA analog output per impurity. An additional serial communication port can be added if required. The interface has a touchscreen to navigate through the different menus. All this package in a 4U rackmount 19 inches industrial enclosure.



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