

LiVision

Inline lithium monitoring in liquids

For lithium extraction and battery recycling

Lithium is largely extracted from brine, either from near-surface brine from salt lakes or from deep geothermal sources. The LiVision inline monitoring system analyzes the lithium content of the brine during the extraction process with high precision and in real time, optimizing lithium extraction.

With LiVision, Fraunhofer IPM has developed a new inline monitoring method for a quick and accurate analysis of the lithium content in liquids. The purely optical method is used to optimize lithium extraction with Direct Lithium Extraction (DLE) or in precipitation processes from liquid media – such as deep geothermic and near-surface brine extraction – as well as for efficient process control in battery recycling.

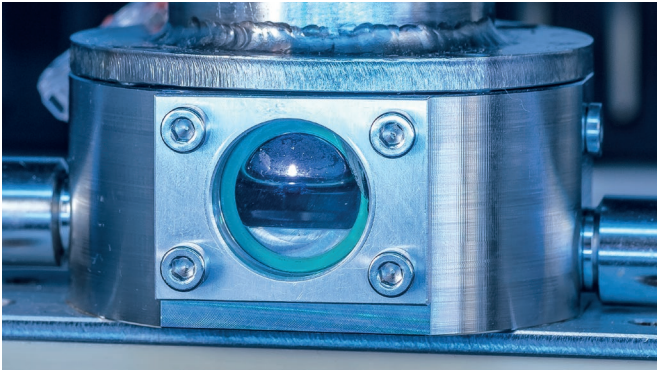
A secure supply of lithium is a crucial factor in the energy transition, as lithium is a key component of batteries. Lithium is primarily extracted from brine – either from near-surface salt lakes or from deep geothermal sources. The Direct Lithium Extraction (DLE) method is increasingly used to minimize water consumption and reduce environmental impact. DLE involves several steps with the duration of each step depending on the composition of the liquid. Fraunhofer IPM's LiVision, an inline lithium monitoring system, analyzes the elemental composition of the brine inline, allowing direct control of the DLE process and thereby increasing efficiency.

Optical sensor, quick measurement

LiVision uses the Laser-Induced Breakdown Spectroscopy (LIBS) method to analyze the lithium content of liquids. The LIBS method applies a short pulse laser to convert a tiny amount of liquid into a plasma. This plasma glows with an element-specific light spectrum. The elemental distribution in the liquid can be quantified from the spectral data obtained in real time. This measured data provides the basis for process control. LiVision works purely optical, without sampling or dilution. The system measures directly in the process under high pressure and temperature and avoids precipitation or outgassing.

Advantages LiVision

- Purely optical process without sampling
- Quantitative analysis of elemental composition
- Direct control and optimization of the DLE process
- Increased efficiency through optimized extraction
- Measurement under process conditions (pressure and temperature)
- Patent pending



LiVision uses a short pulse laser to convert a tiny amount of liquid into plasma. The plasma flash provides valuable elemental information, particularly the lithium content.

LiVision for DLE plants

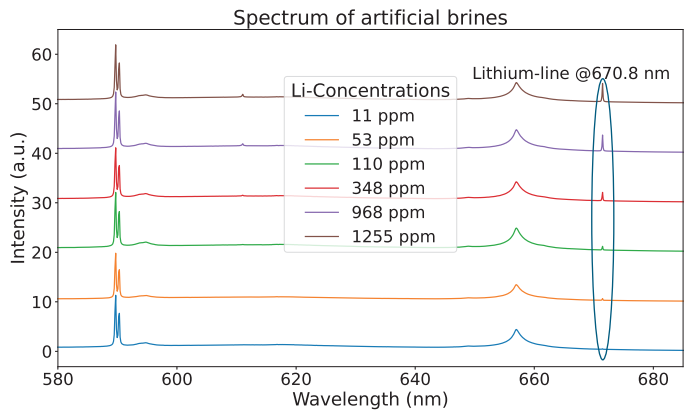
DLE is an environmentally friendly alternative to evaporation. It greatly reduces the use of water in traditional lithium extraction and allows for the development of alternative resources in Europe. The technology is becoming increasingly established on the market and is being tested for specific applications in numerous projects worldwide. The DLE procedure includes sorption, liquid-liquid extraction and membrane processes, which use different materials and have very different process conditions, depending on the lithium source.

During sorption, the brine is first passed through a sorbent that selectively binds lithium. In a second step, the brine is flushed out of the sorbent to remove impurities. In a third step, the lithium is eluted again, followed by another rinse. Losses occur during this process and the duration of each individual step is relevant for its purity and efficiency. Therefore, the control system must be continuously adapted to the composition of the liquid, the process conditions, the aging of the sorbent and other factors. LiVision records all parameters and optimally and efficiently controls the process. LiVision thus ensures the economic efficiency of lithium extraction. This also applies to other applications, such as lithium analysis in battery production and recycling.

System specifications

Measuring range Li content	1–3000 mg/l
Further elemental analysis	Na, Mg, Ca, Sr, K
Measuring time	from 10s
Pressure	1–25 bar
Temperature	up to 80 °C

Specifications are subject to modification without notice.



Laser-Induced Breakdown Spectroscopy (LIBS) provides precise information on the lithium content in liquids in the range of 1-3000 mg/l.

LiVision for battery recycling

Battery recycling is the process of recovering lithium from used batteries. The process involves shredding the batteries and separating their various components. Lithium carbonate is then precipitated from the black mass of active material and lithium in a precipitation reaction. LiVision monitors the lithium content of the liquids during the different stages of treatment, thereby increasing the efficiency and sustainability of the recycling process.

Further applications

LiVision can be easily adapted to a wide range of analytical tasks. It allows for the quantitative analysis of other elements such as sodium, potassium, and magnesium and provides comprehensive control of the recycling process with just one method. The high measuring speed allows measurements directly in the process, which makes the process more efficient and increases the yield.

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