CEMIS

Centre for Measurement and Information Systems

CEMIS Solutions for Mining

CEMIS

Centre for Measurement and Information Systems

CEMIS - the Centre for Measurement and Information Systems is a contract-based joint centre of the Universities of Oulu and Jyväskylä, Kajaani University of Applied Sciences and VTT Technical Research Centre of Finland Ltd. CEMIS specialises in research and training in the field of measurement and information systems.

CEMIS is a community of 110 measurement and information system experts combined with excellent research and training environments. The combined annual funding of the various units is approximately € 10 million.

Competence focuses:

- Process and environmental measurements
- Sports, physical exercise and well-being measurements
- Intelligent systems
- Computer games and simulators

Our aim is to be an internationally desired partner for R&D and training in measurement and information systems. With the support of our committed partners, we will create leading experts, new technology and new business operations in an innovative and international environment. **www.cemis.fi**

UNIVERSITY of OULU
OULUN YLIOPISTO

UNIT of MEASUREMENT TECHNOLOGY CEMIS-Oulu

www.oulu.fi/kajaaninyliopistokeskus/cemis-oulu

Reliable On-line Measurements for Demanding Conditions

CEMIS aims to help mining companies through improving their processes, efficiency and safety, and minimizing an environmental impact through innovative measurement and information systems. Our advantage is in the possibility to create novel measurement solutions by combining the expertise of the various research units of CEMIS.

Mining and mineral processing related services and know-how of CEMIS

University of Oulu – CEMIS Oulu

- Development of sensors based on biosensing, electrochemistry, digital imaging and optical spectroscopy
- Online monitoring devices for harmful components in process and waste water (for example toxic metals and sulfates)
- Bacteria profiling for bioprocesses
- Smart camera solutions for mineral material characterization
- Expert services in analytical chemistry and bioanalysis services

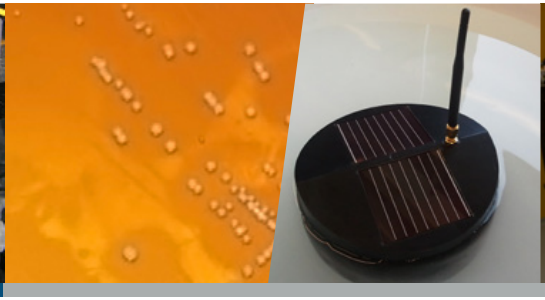
KAMK – Kajaani University of Applied Sciences

- Bachelor level mining engineering education
- Mobile mineral processing laboratory
- Selected analysis services directly for mining companies (element composition and thermogravimetric analysis)

VTT Technical Research Centre of Finland

- Wireless and self-powered sensor networks for harsh environments, e.g. heap leaching process
- Impulse Ultra Wide Band (UWB) radar technology for work safety
- Impulse UWB radar technology for size measurement of crushed ore
- National Metrology Institute's calibration and development services of water flow, force, torque and mass measurements

We provide expert and analytical services directly to mining and mineral processing companies as well as associated technology companies. For an extensive list of our technology portfolio visit our website at ***www.cemis.fi!***

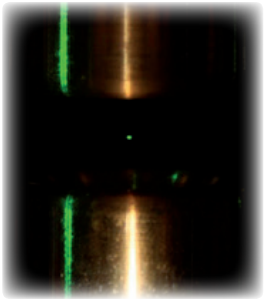

Why automatic on-line monitoring is a good solution?

- To save money and time (less people are needed to control process or pollution)
- More real-time information is available for process control and for reporting (on-line monitoring gives possibility to know continuously, what is really happening)
- Possibility to avoid environmental accidents and problems, since it's possible to react immediately, when something happens
- Possibility to adjust and optimize the process
- Monitor process and pollution everywhere, where is the need (no need to worry about electricity and communication cables)
- Monitor even once a minute
- Monitoring is possible all year around (operates - 40....+80 °C)
- The data is sent to automation system or to Internet wirelessly => very pleasant and fast system

"Save money and protect the environment with our continuous and automatic water quality monitoring solutions.

Our key interest and main focus of activities is on-line measurement solutions.

EDB-LIBS - Advanced laser-based online measurement technology for dissolved elements

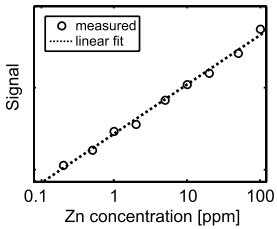


The spectroscopic analysis of electrodynamically levitated droplets (EDB-LIBS) is capable of measuring practically all trace elements dissolved in process or waste water. Advantages of all-optical EDB-LIBS principle are

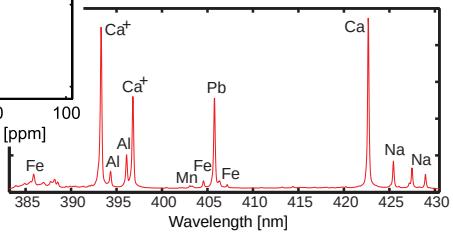
- No chemicals involved
- Low risk of contamination
- Insensitive to pH variations
- Compact, low-maintenance

Benefits of using EDB-LIBS online analyzer in the mining industry are e.g.

- Use water, energy and chemicals efficiently by the active control of closed process water cycle
- Monitor impurities, such as Fe, Al, Mg, C, Si, Ca, Zn, Ni, in the flotation circuit streams
- Early detection of fault situations
- Save laboratory costs
- Monitor liquid emissions and environmental load in real-time



Typical limit of detection (LOD) for metals is 10 mg/l



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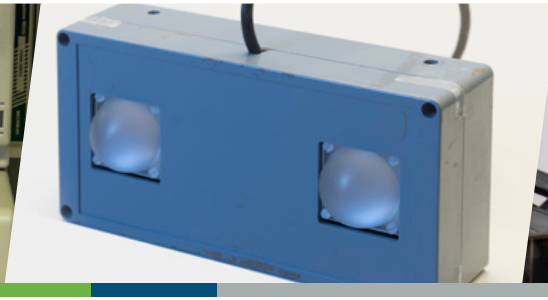
TAMPERE UNIVERSITY OF TECHNOLOGY




Measuring technology development services

We carry out research and development projects in the fields of measuring and information systems in cooperation with companies and research institutes. We explore measuring needs and in cooperation we work out the best way to develop needed measurement solutions. We utilise national and international R&D funding in projects. In addition, we offer services based on company-specific assignments, technology and market surveys as well as theses.

We specialise in the development of reliable on-line measurements for demanding mining industry needs. We develop continuous process measurement methods and real-time systems for the monitoring of waste water from mines, utilising our expertise in optical spectroscopy, electrochemical sensors, biosensors, camera-based solutions, UWB technology and wireless sensor networks. We have access to diverse research and test environments and equipment as well as an extensive international cooperation network. CEMIS annually executes approximately 30 R&D projects. Examples of solutions developed in cooperation with companies:

Impulse Radar Technology for the characterisation of mineral material flows: Ultra Wide Band Microwave-based Impulse Radar technology was developed and successfully demonstrated for the characterisation of mineral material on a conveyor belt. The Impulse UWB Radar is able to estimate the volumetric flow, surface profile and grain size, and detect any oversized or foreign material objects even if they are buried in the material.

Camera-based quality monitoring system for mineral material flows: Noncontact optical on-line measurements of the grain size distribution from a moving conveyor belt has been recently developed. The system comprises fully field-proven in-house wireless (3G) camera-based measurement units for grain size measurement from a moving conveyor belt, full computer server hardware connectable to the wireless measurement units and proven proprietary software code for real-time grain size distribution calculation.

On-line measuring device for trace amounts of metals: Several solutions for on-line detection of toxic metals in mining and mineral processing applications have been developed and demonstrated in real field conditions. Copper, nickel, lead, cadmium, zinc and mercury can be directly measured from process or discharge water down to the ppb-level in real-time. Advanced electrochemical sensors, optical sensors, as well as laser and spark induced breakdown spectroscopy are used. A turn-key solution is already available including integrated automated sampling and sample pre-treatment, wireless data transfer and device control and battery operation. The solution is robust and readily applicable for field use with low maintenance and running costs.

Analysis and test services

We provide analysis and test services to companies based on direct assignments. Our services include analytics, processing, consulting as well as rental of equipment and premises.

Services of KAMK – Kajaani University of Applied Sciences

KAMK studies the properties and behaviour of mineral materials based on company assignments. Customised studies are also conducted in addition to routine tests. The mobile mineral processing laboratory and its equipment can be transported even to the customer's production area if needed. Our services include: beneficiation of minerals, grinding (crushing and milling), sorting based on particle size (sieving, classification and filtering), heat treatment (drying and baking), specification of material composition and dewatering of sludge.

Services of CEMIS Oulu

We provide skilled research scientists and quality services in the fields of electrochemical sensors, optical measuring devices and imaging measurement methods. In addition, our services include chemical analytics, such as the determination of sulphate, ammonium, chloride and nitrate ions. We provide technical support for the development, demonstration and performance studies of various device solutions.

Services of VTT MIKES

The Kajaani unit of VTT Mikes Metrology offers calibration services. The Kajaani unit performs calibrations related to the flow of liquids, force, torque and mass (nominal mass from 50 kg).

Educational services

CEMIS provides training for mechanical and mining engineers as well as specialists in measuring technology.

The Kajaani and Lapland Universities of Applied Sciences together train skilled professionals for the mining industry. Education is provided in three different locations—Kajaani, Rovaniemi and Kemi—utilising online training. The practical exercises included in the studies are done in the mobile teaching laboratory.

Studies in mining and concentration technology
In Kajaani University of Applied Sciences, students can specialise in mining in the degree programme in mechanical and industrial engineering. The specialisations available for engineering students include extractive technology, concentration processes and process technology, energy and maintenance as well as mining environments and construction.

Education in measuring technology is provided as continuing education and as special courses within further education.

CEMIS Business Development

CEMIS Business Development (CBD) initiates and participates in different business and technology-based projects locally and internationally. CBD is also involved in international relations of CEMIS. CBD supports CEMIS partners in project preparation and during project implementation in technology commercialisation.

CBD activities include mainly economic impact studies, market research and technology commercialization. In CEMIS' projects CBD is taking care of the commercialisation aspects of the developed new technology aiming to find markets for the new innovations.

In MEAN project CBD has been involved in helping taking the on-line metal content measurement device from laboratory prototype to a commercialized technology.

2011: *First prototype demonstrated in field measurements.*

2013: *Second prototype applicable for stand-alone field measurements.*

2014: *Latest version integrable into the automatic monitoring station.*

CEMIS

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Technology, expertise and Innovations
Reliable Measurement Solutions | Intelligent Information Systems | Computer games and Simulators

OMS OULU MINING SCHOOL
RESEARCH CENTER

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POHJOIS-POHJANMAA
Council of Oulu Region