LiMCA III
Liquid metal cleanliness analyzer
The LiMCA III is a versatile aluminium cleanliness analyzer that can be used to sample at multiple locations along the casting lines of most casthouses.

The LiMCA III uses the proven LiMCA measurement principle that is the industry standard for measuring non-metallic inclusions in molten aluminium. It can be used under harsh industrial production conditions to provide an accurate indicator for the metal cleanliness of aluminium alloys. The LiMCA III takes advantage of a lighter measuring head for more versatile and flexible positioning in molten metal than previous LiMCA analyzers. Its lower center of gravity makes it also more stable and easy to maneuver. Furthermore, the LiMCA III comes with a laser level sensor that enables automatic raising and lowering of the measurement head to adapt to the varying levels of molten metal during a cast.

LiMCA III Measurement Overview

The LiMCA III system measures total concentration and size distribution of inclusions found in aluminium alloys. Its measuring principle is based on an objective and user-independent method. It is ideally suited for process control and quality assurance. The LiMCA III system can characterize the cleanliness of a melt at time intervals in the order of one minute. It can therefore monitor, in real-time, the evolution of cleanliness along a cast as a function of process parameters and melt-handling practices. The impact of furnace preparation, alloying practice, feedstock mix, settling time, and similar parameters on melt cleanliness is easily determined.

To maintain their competitive edge, world-class aluminium plants must precisely monitor the quality of their aluminium production in real time. They need to find crucial information at a glance and easily access their process data. The LiMCA III can meet all these challenges.

Features

- Online real-time inclusion measurement
- Concentration and size of inclusions
- Measurement at any point along the process
- AC modulation to eliminate the use of batteries
- Readings unaffected by the electromagnetic noise of casting environments
- Standard web-based HMI runs on most computers and tablets
- Self-contained analyzer (dedicated server not required)
Effects of settling on cleanliness
Setting time is often based on experience. What if you knew the level of cleanliness you could achieve just by selecting the right settling time in your furnace? Without this information, productivity is lost.

Inclusion release from a sudden metal level change while casting
When systems are unstable, variations in quality occur. What if you knew how and why your process was unstable? Without this information, it is difficult to know the cause of your rejects.

LiMCA results showing filter efficiency
Top quality producing plants rely on expensive in-line filtration systems. What if you knew your filtration efficiency and its limitations? Without this information, you may use your filtration system incorrectly.

Web-based software
The LiMCA III is operated via a web-based software. There is no need to install any software in customer control systems or computers. The software is built in the LiMCA III and can be accessed via a web browser.

The technique used is based on the resistive pulse/electric sensing zone (ESZ) technique. LiMCA III systems measure the total concentration and granulometry of dielectric inclusions in suspension in molten aluminium and aluminium alloys. The workings of a basic LiMCA instrument are illustrated in the following figure. The instrument supports a closed tube, with a small orifice, that is positioned in liquid metal. A vacuum created inside the tube forces the liquid metal and its suspended particles to flow through the small orifice, filling the tube. This tube is made of electrically insulating material. There are two types of electrodes: one in-probe electrode located inside the tube, and four external electrodes. All electrodes are immersed in the liquid metal. An alternative electrical current is applied between the in-probe and the external electrodes, and flows through the liquid metal in the small orifice of the tube. The presence of a particle in the liquid flow, when going through the orifice, modifies the electrical resistance detected at the orifice.

When a particle enters the orifice, it displaces its volume of the conducting fluid, causing a temporary rise in the electrical resistance of the orifice. This resistance change, in the presence of the applied current, causes a voltage pulse of duration approximately equal to the transit time of the particle to appear across the orifice. The electrical potential produced by the constant current varies in relation to the change in resistance each time a particle goes through the orifice. A detection circuit determines the size of the particle from the change in voltage caused by its presence. The magnitude of the change depends on the volume of the particle. A difference in voltage due to the passage of a particle takes the form of a pulse on the reference line. The reference line corresponds to the voltage created by the constant current going through the circuit consisting of the electrodes and the liquid metal when no inclusions are present.
Versatile and flexible positioning of measuring head
1. Upward/downward mechanical actuator positioning system
2. Forward/aft manual positioning rail system
3. Automated/manual electrical actuator with tracking system
4. Three positioning systems combined to offer a wide range of motion

Measurements
- Particle size measurement: 20 to 155 µm
- Particle size detection: 15 to 300 µm
- Inclusion concentration (numerical): 0.05 to 1000 k/kg
- Reproducibility at high inclusion concentration: ±10%
- Reproducibility at low inclusion concentration: Dominated by statistical noise

Ambient specifications
- Operating ambient temperature: 0 to 50 °C (32 to 122 °F), with active cooling
- Storage ambient temperature: –20 to +40 °C (–4 to 104 °F)
- Ambient humidity: 35 to 85% RH, non-condensing

Electric power supply specifications
- Rated nominal line voltage: 100 to 240 VAC, autoselect
- Line voltage phases: Single, neutral grounded VAC
- Maximum line voltage fluctuation: 10%
- Rated frequency: 47 to 63 Hz
- Rated power consumption: 200 VA average, 450 VA peak
- Breaker type (100 to 240 VAC): 5A, 2 poles, Tripping curve K (according to IEC/EN 60947-2)
- Minimum extension wire gauge: 18 AWG

Laser specifications
- Laser classification: Class 2 (IEC) / wClass II (FDA)
- Laser power: Less than 1 mW
- Laser light source wavelength: 655 nm
- Laser measuring range: 200-1000 mm (7.9 - 39 in)
- Laser measuring resolution: 0.3 mm

Analyzer mechanical specifications
- Mass: 80 kg (176 lbs)
- Height: 1260 mm (50 in)
- Width: 510 mm (20 in)
- Depth: 470 mm (19 in)
- Transit case mass: 65 kg (143 lbs)