

Liquid Metal Cleanliness Analyzer for Continuous Monitoring

- Direct, in-line and real-time inclusion measurement
- Fully automated
- Minimum maintenance
- Integrated to the Process

To maintain their edge, world-class aluminum plants must be able to monitor in real-time and with precision the quality of their liquid aluminum. They must be able to access process data easily and be able to find crucial information at a glance.

LiMCA CM can meet this challenge.

ABB's LiMCA CM is the proud successor of the well known LiMCA II. Designed for robustness and reliability, the LiMCA CM can run continuously (7/24) in the harsh environment of aluminum plants and requires minimal scheduled maintenance.

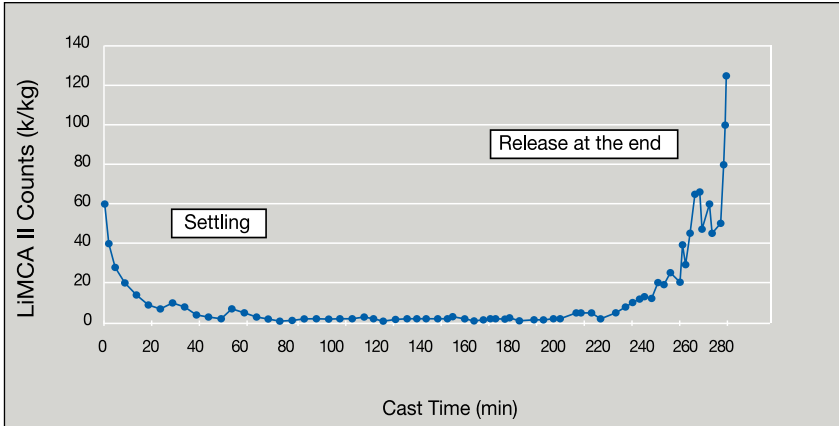
The LiMCA CM allows for in-line, real-time measurements. Inclusion monitoring is tracked every minute providing a detailed view of process quality at all times.



LiMCA CM Measurement Overview

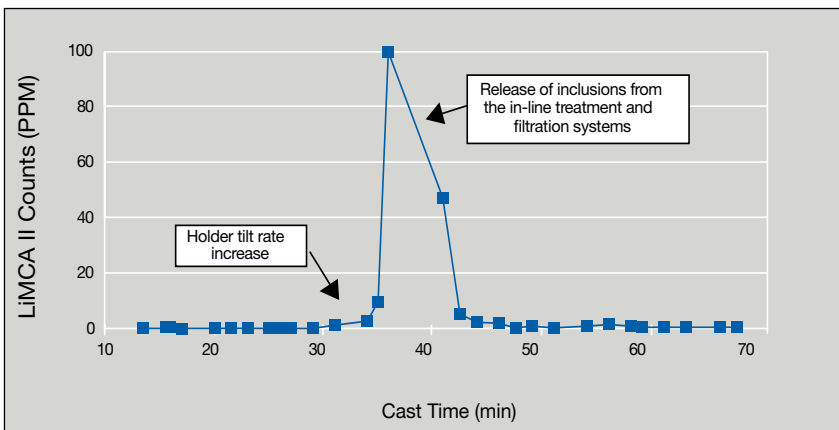
The LiMCA CM system measures total concentration and size distribution of inclusions present in aluminum alloys. Its measuring principle is based on an objective and user-independent method. It is ideally suited for process control and quality assurance.

The LiMCA CM 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.



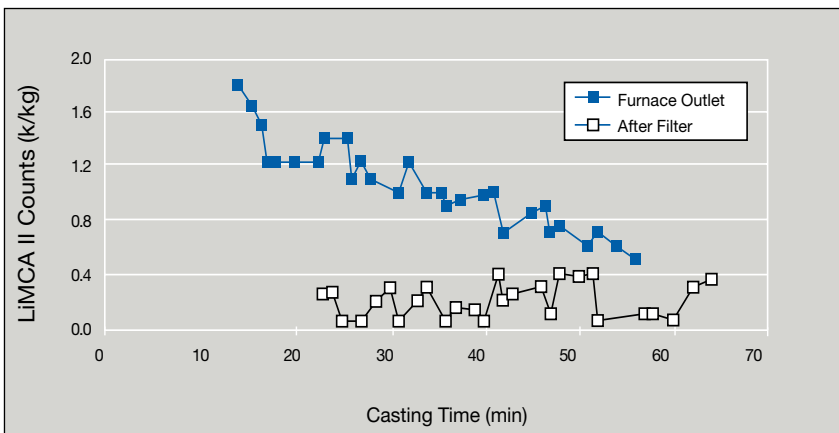
Effect of settling on cleanliness

Settling 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.

LiMCA CM Benefits

The LiMCA CM is designed to operate continuously (24/7), readily providing inclusion measurement data directly to the casting database system with minimal operator intervention. It is installed at a stationary location and operates autonomously.

Integrated to the process: The LiMCA CM system is installed above the launder and is integrated to the process software environment.

Automated measurement: When molten metal starts to flow, the LiMCA CM detects it, lowers to immerse its probes and starts measuring. This is done automatically without any user intervention. At the end of the cast, the LiMCA CM raises from metal and stops measurement.

Minimal operator intervention: When the LiMCA CM is in its upper position, a casting operator installs a new probe. Then, the LiMCA is ready for the next cast. No additional user intervention is required.

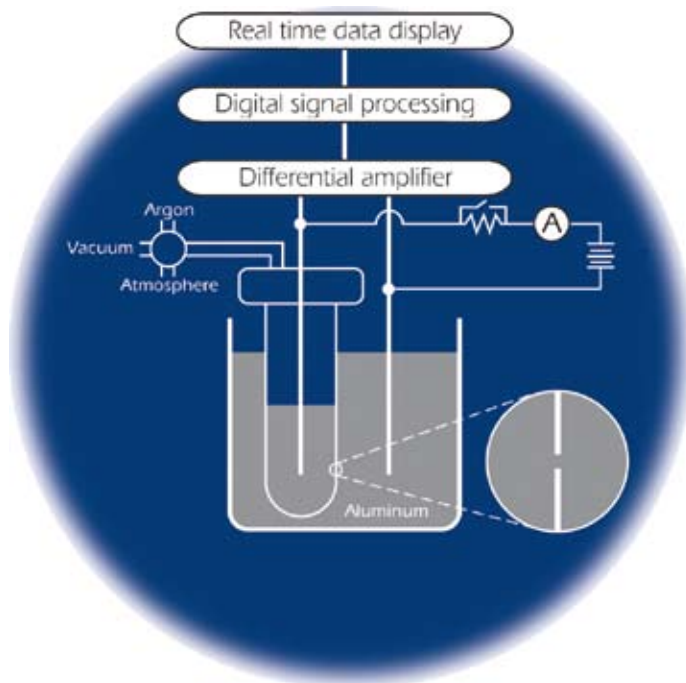
Robust design: The LiMCA CM system is designed to operate in harsh plant environment. It has an integrated cooling system to withstand the heat. Its modular design makes it easy to maintain: If a module breaks, it can be easily troubleshoot and replaced in minutes.

Theory of Operation

The LiMCA CM system measures total concentration and size distribution of inclusions suspended in aluminum alloys.

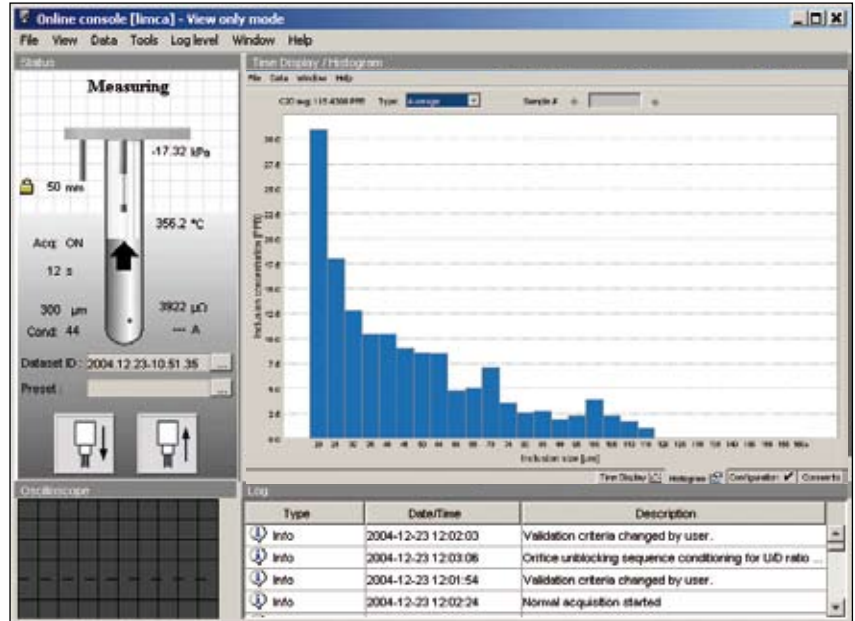
The heart of the measuring system consists of a closed glass tube (electrically insulating material) bearing a small orifice at its bottom. The tube is positioned in liquid metal. By creating a vacuum inside the tube, the metal with the suspended inclusions to be detected is forced through the small orifice.

Two electrodes are necessary: one inside the tube and the other outside. Both electrodes are immersed in the liquid metal. A constant electrical current is applied between the electrodes. The current flows through the liquid metal by the small orifice in the tube.





When an inclusion enters the orifice, it displaces its volume of conducting fluid, temporarily rising electrical resistance. The increase of resistance generates a voltage pulse. The magnitude of the voltage pulse is a function of the volume of the particle. The duration of the pulse is related to the transit time of the inclusion. The voltage pulses are amplified and their amplitude measured digitally. The size distribution and total concentration are displayed in real-time on a computer screen.



Why LiMCA II users should upgrade to the LiMCA CM

The LiMCA CM requires minimal maintenance and it is much more reliable than LiMCA II.

The LiMCA CM operates autonomously: only minimal interventions, such as replacing the probes, are required and can be easily done by the operators. Well-trained technicians or metallurgists can focus on more important tasks than routine operation.

The LiMCA CM modular design reduces significantly the maintenance required. Replacement of any defective part is made easy.

Other benefits:

- Simpler to configure
- Robust probe seal
- Robust in-probe thermocouple assembly
- Robust maximum immersion detector
- Only three electrodes
- No more batteries to change: replaced by Ultra-capacitors
- Metal level float replaced by a laser.

ABB's LiMCA CM brings liquid aluminum process monitoring one step further to simplicity and efficiency.



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Liquid Metal Cleanliness Analyzer for Continuous Monitoring



Analyzer performance specifications

Particle size measurement	20-155 μm
Particle size detection	15-300 μm
Inclusion concentration (numerical)	0.05-1000 k/kg
Inclusion concentration (volumetric)	1-100,000 PPB
Reproducibility at high inclusion concentration	$\pm 10\%$
Reproducibility at low inclusion concentration	Dominated by statistical noise
Typical melt sample mass	17.5 g
Typical melt sample volume	7.5 ml
Typical data sample interval	80.0 seconds

Analyzer ambient operating and storage specifications

Operating ambient temperature	0-50 C	32-122 F
Storage ambient temperature	-40-85 C	-40-185 F
Internal operating temperature	0-65 C	32-149 F
Ambient humidity	5-95 % RH non-condensing	

Analyzer electrical supply specifications

Rated nominal line voltage	100-120 or 220-240 VAC	
Line voltage phases	Single, neutral grounded VAC	
Maximum line voltage fluctuation	10 %	
Rated frequency	47-63 Hz	
Rated power consumption	750 VA	
Breaker type (115VAC)	10A, 2 poles, Curve C	
Breaker type (230VAC)	10A, 2 poles, Curve C	
Minimum extension wire gauge	14 AWG	

Analyzer compressed air supply specifications

Maximum temperature	40 C	104 F
Input pressure	690 kPa	100 PSI
Maximum input pressure	1725 kPa	250 PSI
Flow at 690kPa (100PSIG)	850 SLPM	30 SCFM
Filter	5 μm	
Oil content	Oil free	
Dew point	-40 C	-40 F
LiMCA air hose internal diameter	12.7 mm	0.5 in
Plant air hose minimum internal diameter	12.7 mm	0.5 in

Analyzer compressed argon supply specifications

Maximum temperature	40 C	104 F
Minimum pressure	550 kPa	80 PSI
Maximum pressure	760 kPa	110 PSI
Minimum flow	0.015 m ³ /min	0.5 SCFM
Filtration size	40 μm	
Purity	99 %	
Dew point	-40 C	
LiMCA argon hose internal diameter	6.35 mm	0.25 in
Plant argon hose minimum internal diameter	6.35 mm	0.25 in

Analyzer communication interface specifications

Network interface type	Ethernet 10/100baseT
Network interface connector	Industrial RJ45
Network interface cable type	Strait shielded



Analyzer laser specifications

Laser classification	Class 2 (IEC) / Class II (FDA)	
Laser power	less than 1 mW	
Laser light source wavelength	635 nm	
Laser light source	visible red light	
Laser clearing distance	250 mm	9.8 in
Laser measuring range	500 mm	19.7 in
Laser measuring resolution	0.1 mm	0.004 in

Analyzer mechanical specifications

Mass	60 kg	132 lbs
Perceived mass with counter weight	10 kg	22 lbs
Height	1011 mm	39.8 in
Width	475 mm	18.7 in
Depth	457 mm	18.0 in
Enclosure height	844 mm	33.2 in
Enclosure width	380 mm	15.0 in
Enclosure depth	385 mm	15.2 in

Actuator performance specifications

Vertical maximum travel	480 mm	18.9 in
Vertical movement precision	1 mm	0.039 in
Maximum time to move over full vertical travel	30 seconds	
Upper and lower limit switch positions	Adjustable	

Actuator ambient operating and storage specifications

Minimum operating ambient temperature	0 C	32 F
Maximum operating ambient temperature	50 C	122 F
Minimum storage ambient temperature	-40 C	-40 F
Maximum storage ambient temperature	85 C	185 F
Minimum internal operating temperature	0 C	32 F
Maximum internal operating temperature	65 C	149 F
Minimum ambient humidity	5% RH	
Maximum ambient humidity	95% RH non-condensing	
Minimum internal humidity	5% RH	
Maximum internal humidity	95% RH non-condensing	

Actuator mechanical specifications

Mass	57 kg	126 lbs
Height	1411 mm	55.6 in
Width	210 mm	8.2 in
Depth	291 mm	11.5 in

Server computer requirements

Recommended processor type	Intel Pentium III or better
Recommended processor clock speed	1800 MHz
Minimum RAM	256 MB
Minimum recommended RAM	512 MB
Minimum available hard-disk space	1 GB
Recommended available hard-disk space	5 GB
Network connection type	10/100 BaseT
Video card and screen resolution	1024x768 pixels
Video card minimum number of colors	256
Minimum peripherals	Keyboard, pointing device, CD-ROM drive
Tested operating system	Microsoft Windows 2000

Console computer requirements

Processor type	Intel Pentium III or better
Recommended processor clock speed	1800 MHz
Minimum recommended RAM	256 MB
recommended available hard-disk space	1 GB
Network connection type	10/100 BaseT
Video card and screen resolution	800x600 pixels
Video card minimum number of colors	256
Minimum peripherals	Keyboard, pointing device, CD-ROM drive



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