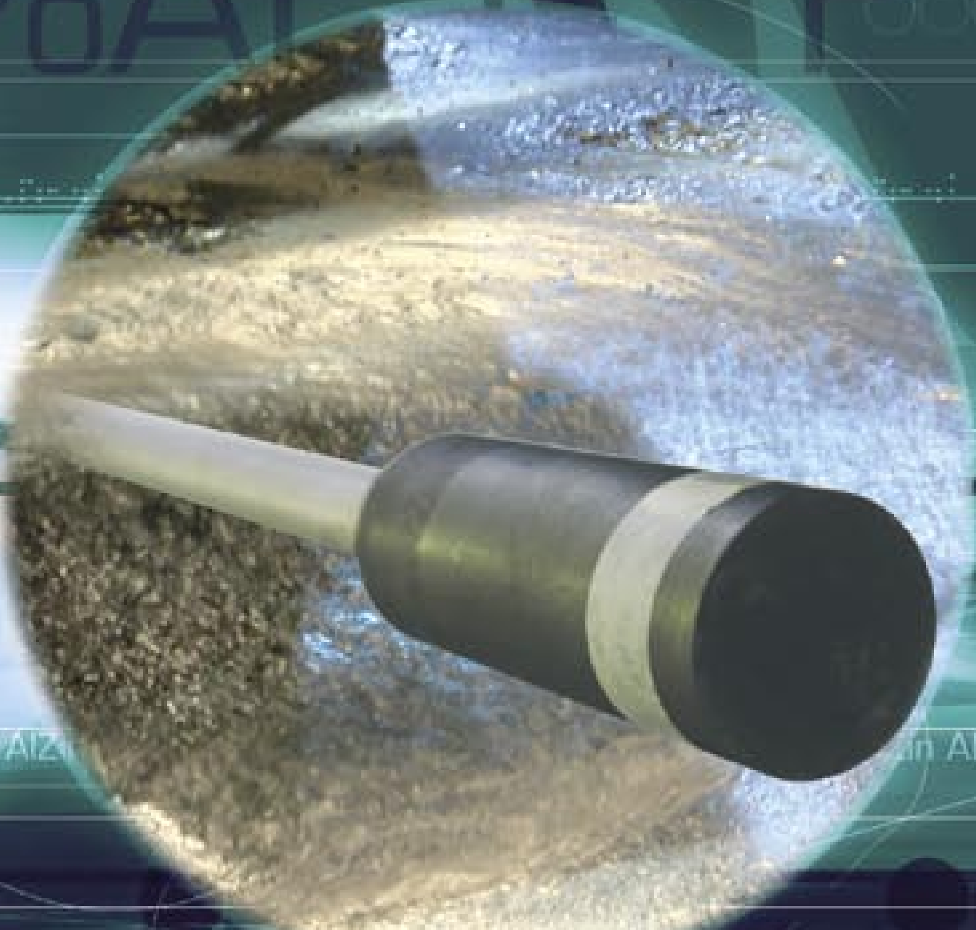
Heraeus

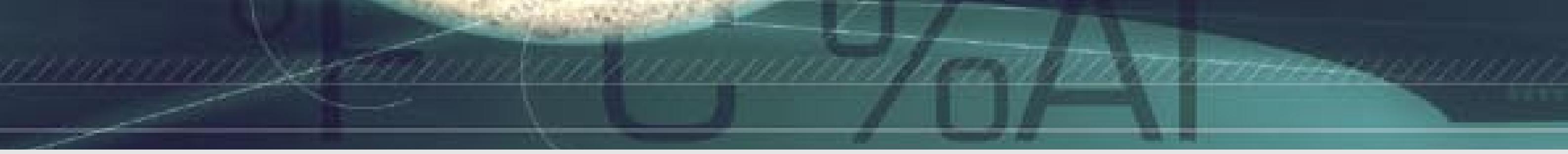
AlZin

Aluminium control in galvanizing zinc pots



The masters when it comes to control techniques

Electro-Nite



High quality strip steel galvanizing requires close control of the aluminium concentration in the zinc bath. The formation of intermetallic zinc-aluminium-iron phase in coatings and dross leads to a reduction of effective aluminium in the zinc pots, and thus aluminium has to be periodically readjusted.

Traditionally galvanizers have been taking periodic bath samples for analysis, typically 2 per day. The problem with batch sampling is that it is not possible to rapidly respond to changes in the zinc bath composition. Also the traditional analytical techniques, ICP and spectrometer, determine the total Al content and not the effective aluminium which is the relevant parameter for process control. Heraeus Electro-Nite, the world market leader in molten metal sensor technology, together with Vito and Umicore have developed AlZin, a high-tech sensor to accurately monitor continuously both, bath temperature and dissolved aluminium in galvanizing zinc pots.

Why measure aluminium in zinc?

The effective aluminium concentration in zinc determines the quality of the zinc coating layer like surface shine, corrosion resistance and durability. Effective aluminium has to be controlled within narrow limits. Typical effective aluminium levels in the zinc bath are :

- Batch galvanizing: max. 0.050% Al
- Galvanneal: max. 0.130% Al
- Galvanizing: max. 0.360% Al

Dross formation is minimized by keeping the effective aluminium concentration as stable as possible.

$$Al_{effective\ (AlZin)} = Al_{tot\ (Lab)} - Al_{(dross)}$$

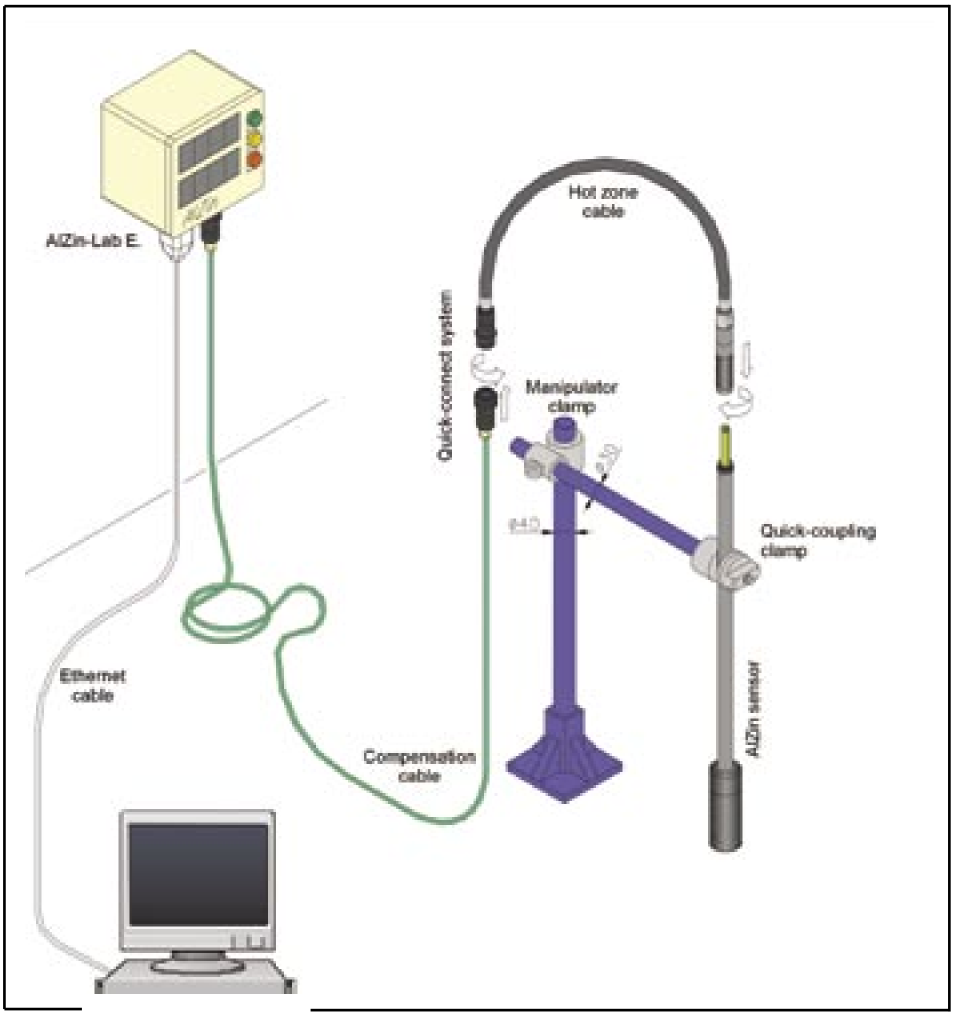
How is effective aluminium measured?

AlZin → electrochemical sensor

(+) Ta/Al in Zn(l) // liquid salt // Al(s)/Ta(-)
Reference: $Al(s) \rightarrow Al^{3+} + 3e^-$
Bath: $Al^{3}+ + 3e^- \rightarrow Al$

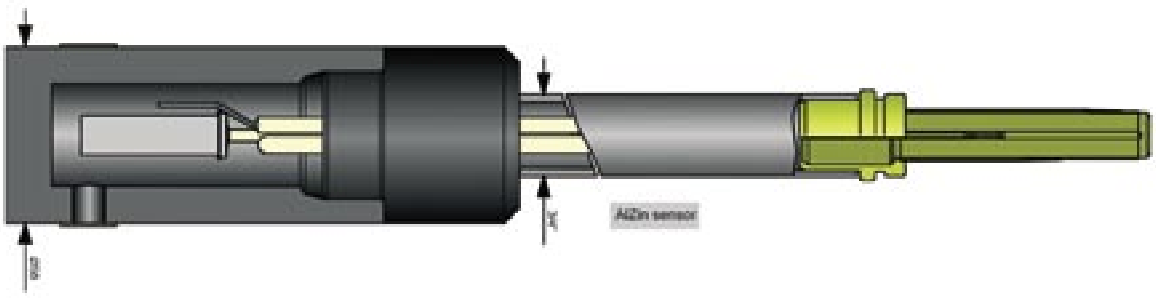
$EMF \sim T\ (zinc) * \ln a_{Al}$

AlZin system – sensor, cable, instruments



The AlZin sensor

- Sensor housing: rigid industrial construction for the harsh zinc-pot environment. Anti-corrosive stainless tubing suitable for inductively heated pots. Inert graphite cell chamber for high precision combined to long sensor service life.
- Free of thermal shock.
- Quick-connect cable coupling (plug & play).



AlZin sensor and Hot Zone cable

- Hot Zone cable with quick- connect contact block
- Sturdy stainless steel sensor housing with quick-connect contact system
- Non-reactive large sensor graphite chamber design allowing for both, precision and a long service life.

AlZin – Instrument

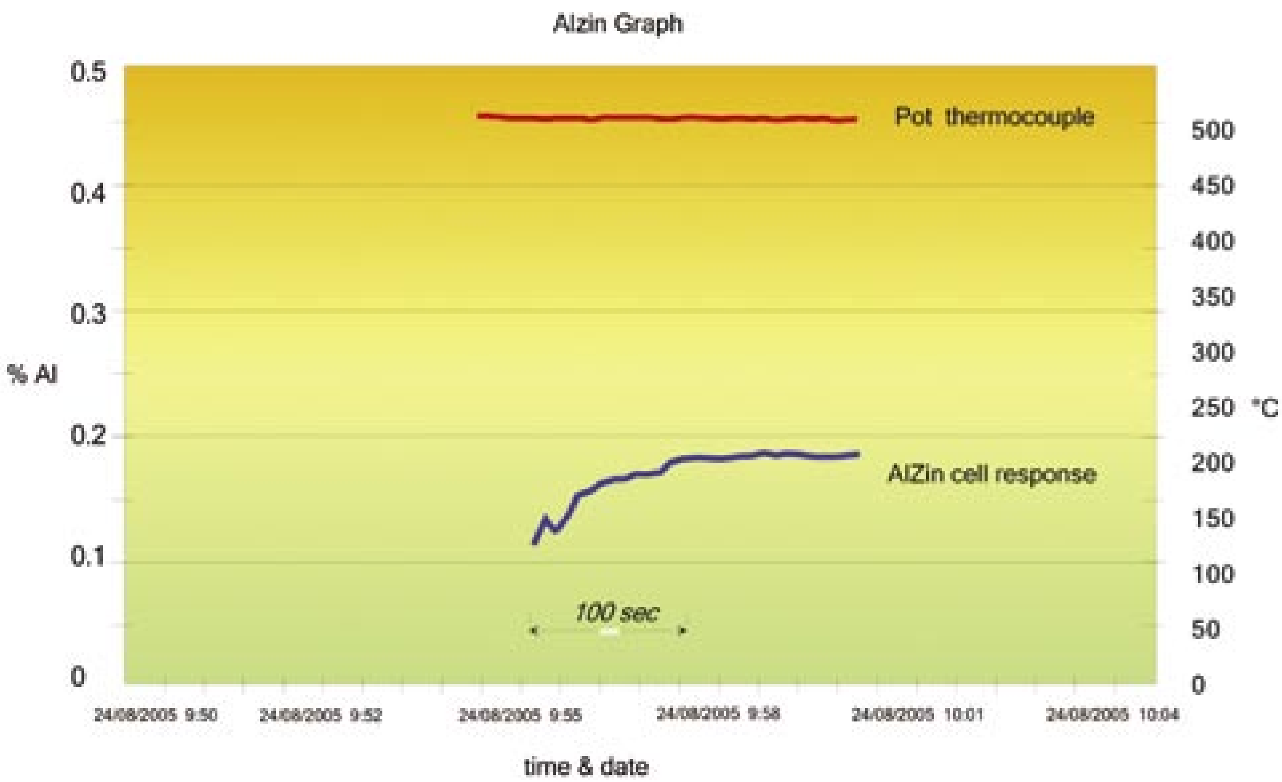
Cell voltage plus zinc pot temperature are signal converted using the new Heraeus Electro-Nite AlZin-Lab E. This fully programmable instrument signalizes the measurement status (lamps). It displays the molten zinc temperature (Celsius or Fahrenheit) and the aluminium concentration (% or ppm).

AlZin-Lab E may be connected to a dedicated PC or server PC via a serial Com port or via Ethernet (TCP/IP). Optionally Profibus and Modebus can be offered. The sent data strings may be used for in-plant logistics. The optional AlZinlog PC-software makes it comfortable to compute the measured data, and further process it in various Windows programs.

AlZin set in operation

AlZin immersion is easy with non-sophisticated holders.
Sensor is placed by operating line people, not requiring mechanical or electrical maintenance staff. The sensor change-over time in less than 5 minutes.
Quick-connect solutions enable plug & play.

AlZin response time from cold to application temperature



Change-over of GI-GA-GI-GA-GI in a continuous zinc-coating line

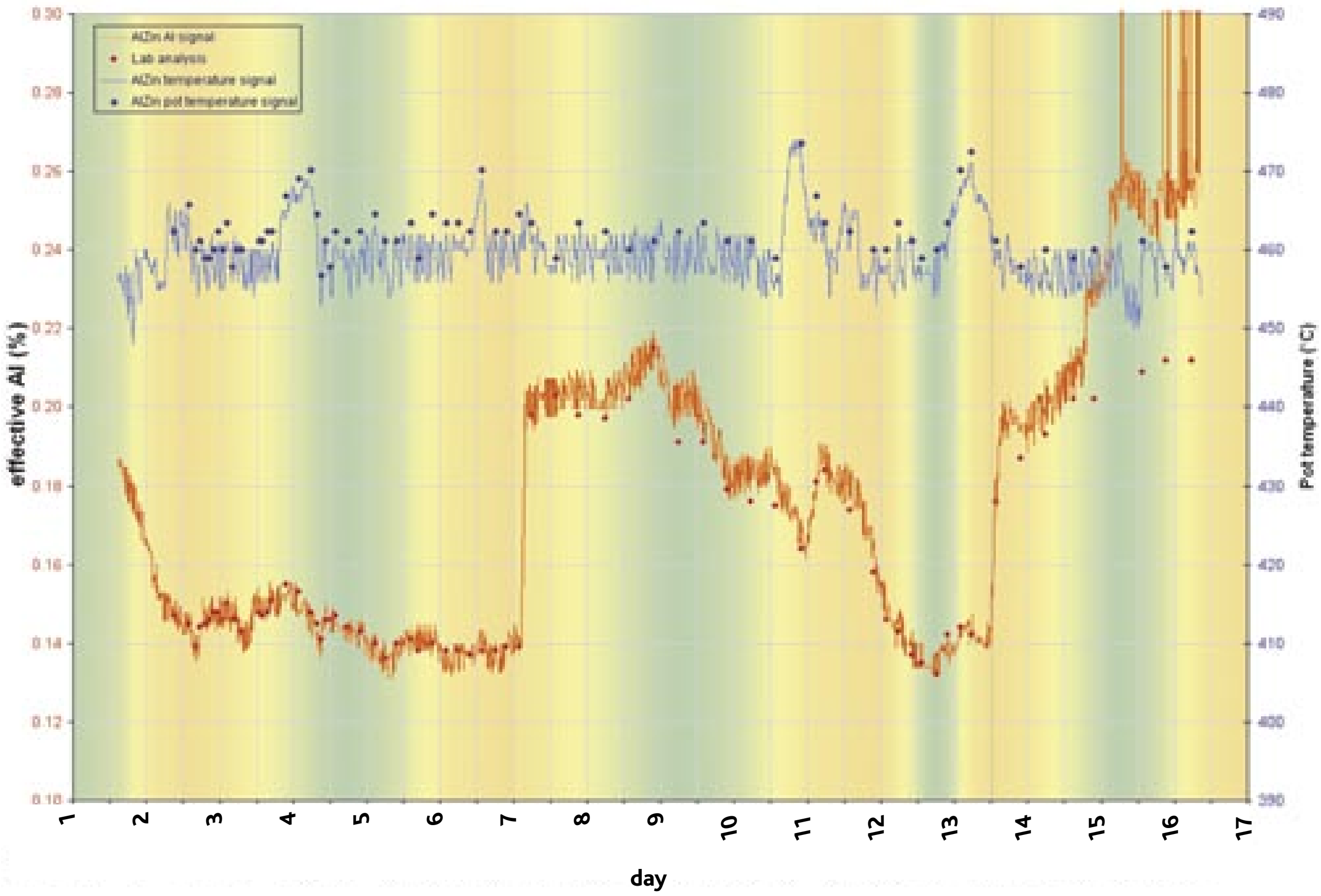
AlZin traces effective aluminium changes perfectly. Transitions from GI to GA and vice versa are perfectly being monitored. AlZin responds correct to even extreme aluminium jumps. Examples:

a) Rising

+0.0150% Al/h during transition from GA (0.140%Al) > GI (0.200%Al) within 4hrs

b) Falling

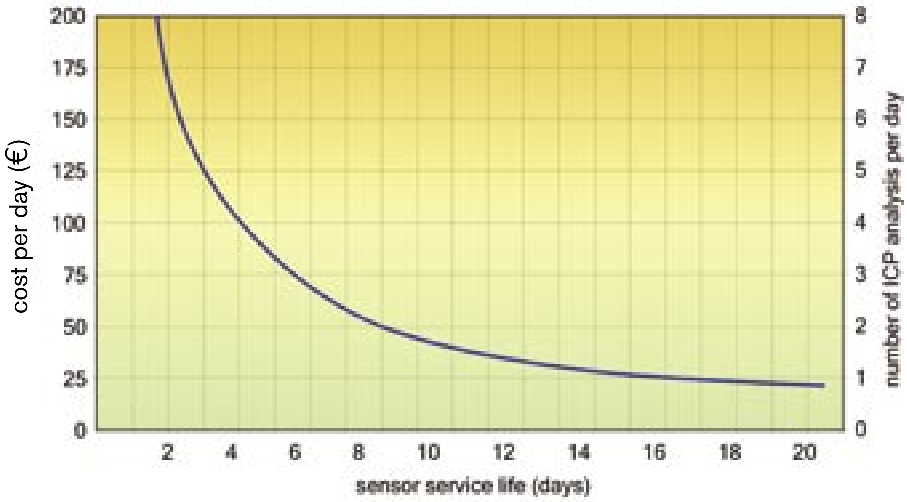
-0.0075% Al/h during transition from GI to GA within 6.5hrs.
The sensor's lifetime was 2 weeks of uninterrupted service. The deviation to the comparative ICP analysis was R (sqr) = 0.9835 over the period.



Positioning the AlZin sensor in the zinc pot

A good position to place the sensor is typically the pot thermocouple site.
Mechanical damage from dross raking and thermal damage from gas flaming must be avoided.
A turbulent area should not be selected for AlZin positioning.
The zinc ingot charging area is less suitable.
Immersion depth should be ~ 450mm.

Cost comparison of sensor to Lab(ICP) analysis



Overall system benefits

The quality aspect
The continuous control of effective aluminum in zinc keeps a constant metallurgical coating process and minimizes dross formation. It enables improved process management and drift analysis.

The cost aspect
Dross reduction leads to less build-up on rolls and thus enables less frequent roll changes.

The laboratory aspect
Aluminium activity and the temperature in zinc are directly obtained from the sensor.

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