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galvalibs

FOUNDRY SOLUTIONS
& Metallurgical Services Inc.

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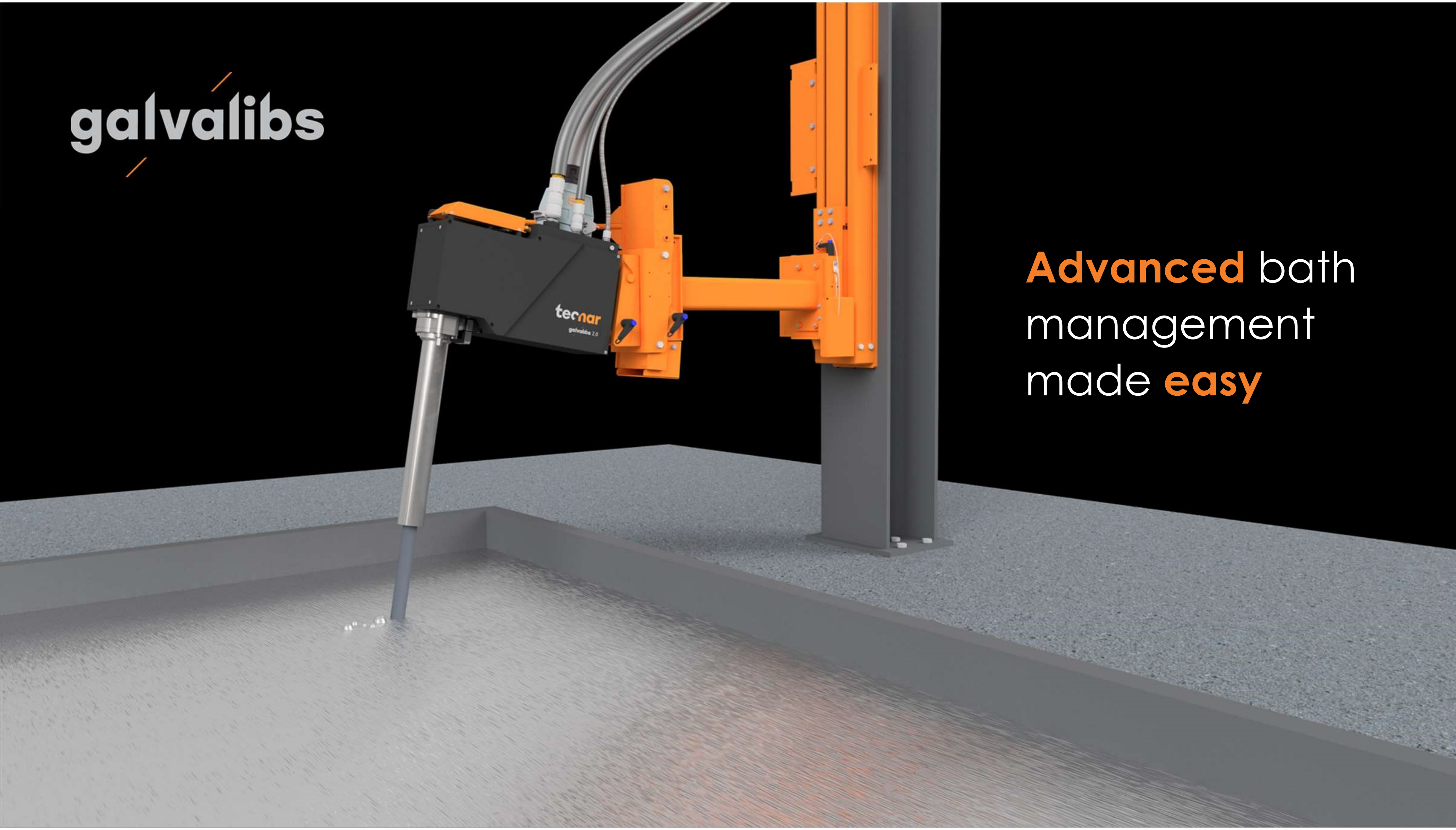
galvalibs
Advanced bath management made easy
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The need for advanced process control

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Complete control over manufacturing process requires

1 Constantly monitoring changes of the production process

- Unavoidable chemistry drift in pot

2 Compare key measurements to predetermined tolerance windows

- Automatically alert operators before product characteristics fall out of specifications
- Allow for the planning of maintenance “on-demand”, instead of maintenance ”on schedule”

Our strategy

Earlier insight changes everything

The Galvalibs is a **laser-based** analyzer that provides **online multi-element chemical monitoring** of the galvanization and the aluminum melting processes.

The Galvalibs provides:

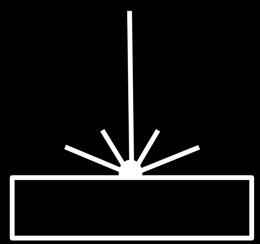
- Direct measurement of soluble phase – no phase diagram required
- Soluble fraction of Al, Fe, Mg and Si
- Tested and certified on production lines - Drift below 1% relative over 4 weeks
- Solid phase monitoring – Dross
- Pot level measurement

** The Galvalibs is unaffected by skimming activities or dross accumulation*

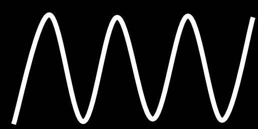
Easy plant interface

Intuitive user interface with powerful analytical tools that helps mill operators and engineers quickly understand what is going on and to reach their goal.

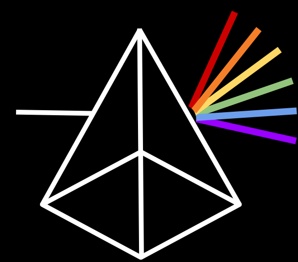
How it work



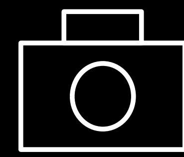
A laser pulse creates a plasma on the target and the light emitted follows the presence of elements



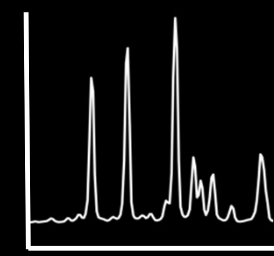
The light emitted by the plasma is collected



The collected light is delivered to a spectrometer which separates light into a spectrum



A CCD camera records the separated light



Analysis of the spectrum leads to quantitative measurement of specific elements

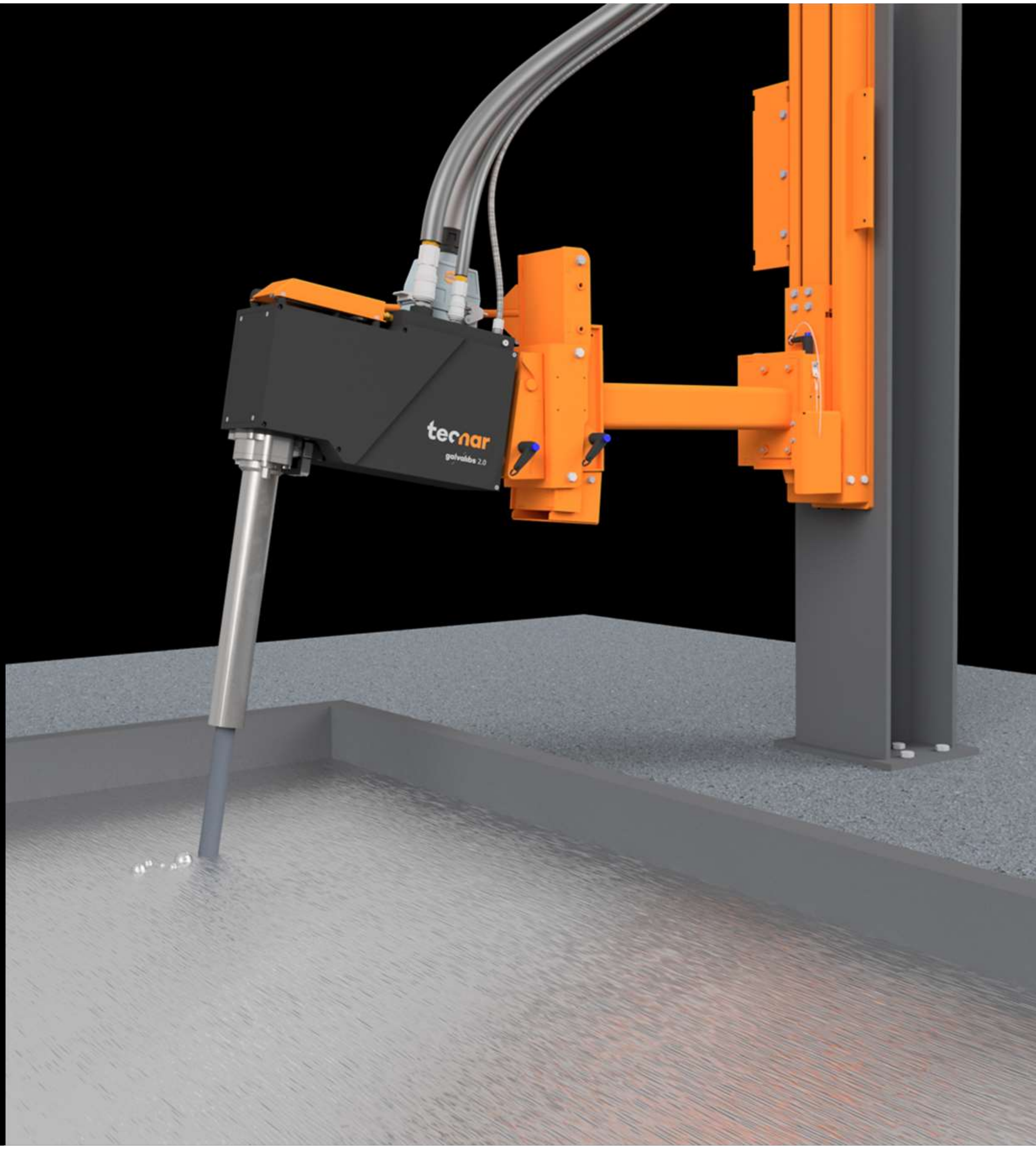
How does the Galvalibs works

1. A ceramic lance is plunged underneath the surface of the melt

1. An argon flow is maintained in the lance to prevent metal from rising in the lance

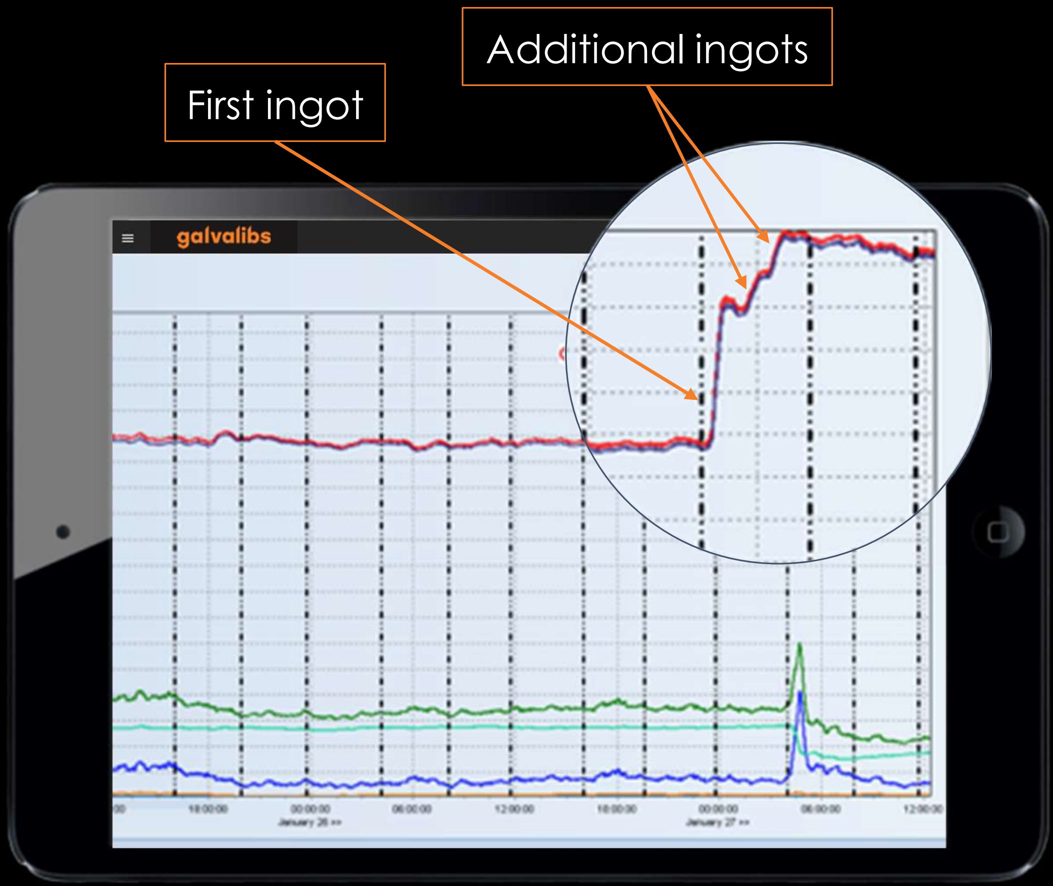
1. The laser fires, triggering a plasma underneath the surface of the melt, inside the bubble, accessing clean molten metal

1. An optical fiber collects the light emitted by the plasma and delivers it to the spectrometer



Transition from GA to GI production

- Galvalibs allows direct monitoring of transition from GA to GI production
- Real-time data shows the impact of addition of ingots in pot
    - Operator can more closely visualize what is going on with **aluminum concentration**

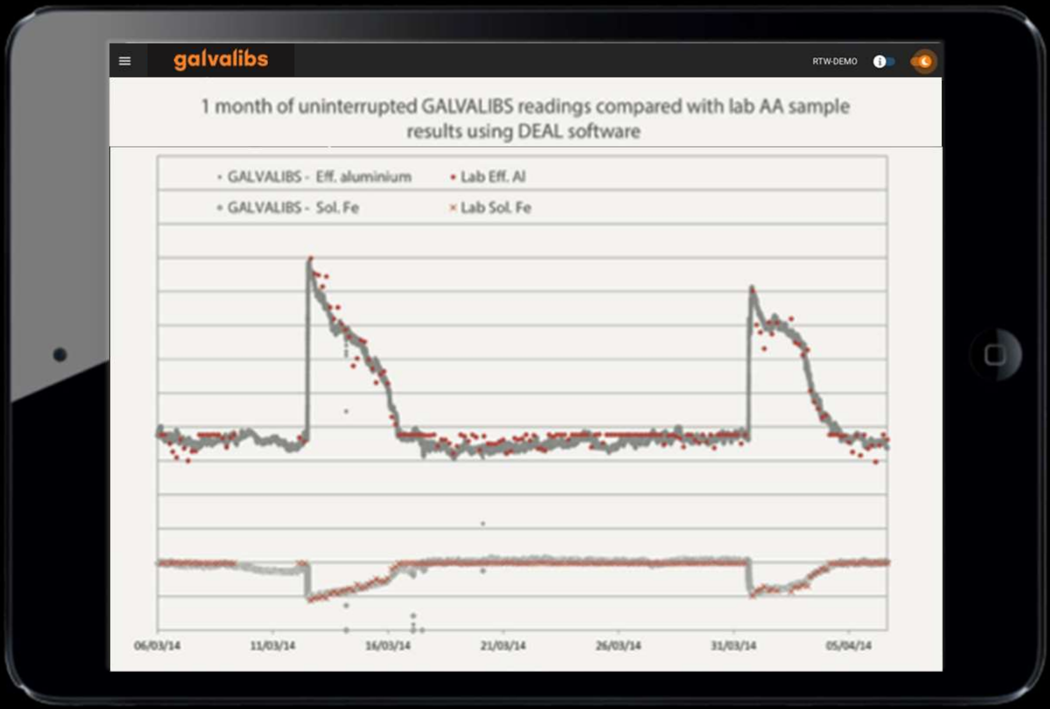


Transition from GA to GI production

- Galvalibs allows direct monitoring of transition from GA to GI production
- Real-time data shows the impact of addition of ingots in pot
  - Operator can more closely visualize what is going on with **dross creation**

Comparison of online Galvalibs reading with laboratory measurements

- Measurement taken over several weeks
  - Comparative data taken every 4 hours
- Laboratory analysis with atomic absorption method
- Perfect score for effective Al and Soluble Fe
- No re-calibration of Galvalibs during the complete test period
- No need for an external lab



Completely autonomous calibration

Easy to use calibration unit for monthly certification of the Galvalibs:

- Plug and play
- Fully automated: no human intervention, no human error

Accuracy better than 2% RSD

- Equivalent to standard laboratory equipment

With the Galvalibs calibration unit

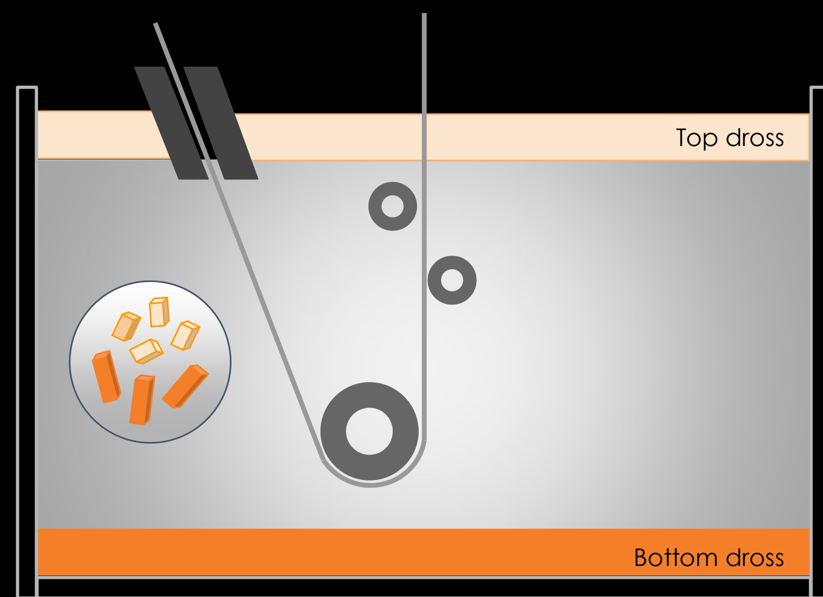
- Get rid of the external laboratory
- Provide better performance for you

1 Real-time dross monitoring

Dross is present inside the pot, that will float to surface or drop to the bottom of the pot.

Zinc bath with dissolved **Al** and **Fe**

Light intermetallic particle moving towards the surface **$Fe_2Al_{5-x}Zn_x$**

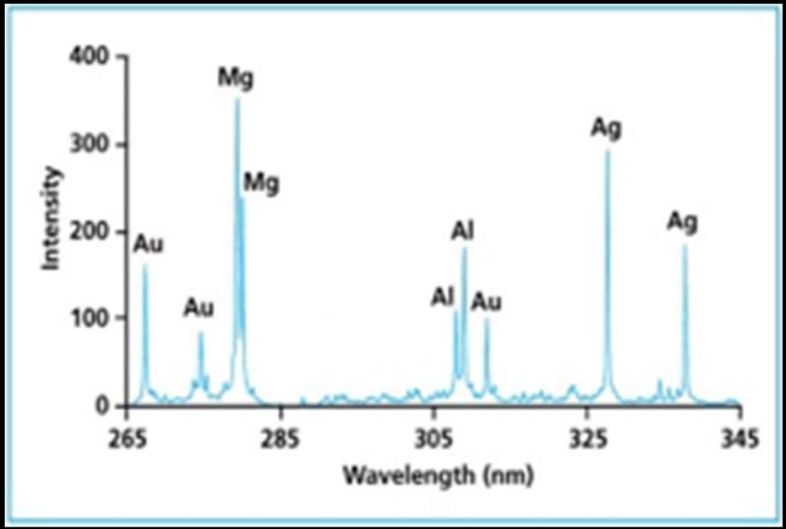


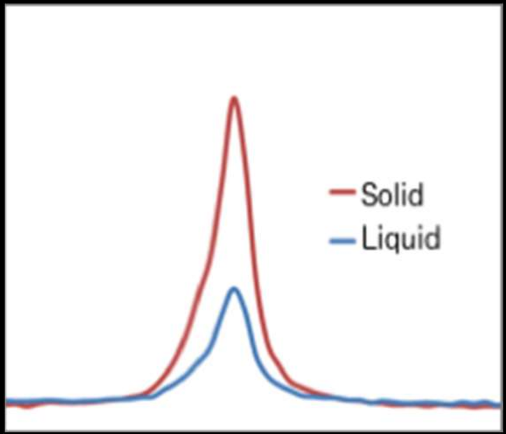
Heavy intermetallic particle moving towards the bottom **Fe_2Zn_7**

2

Real-time dross monitoring

Strong discrimination in optical signal from solid sample (dross) and for liquid sample (dissolved)

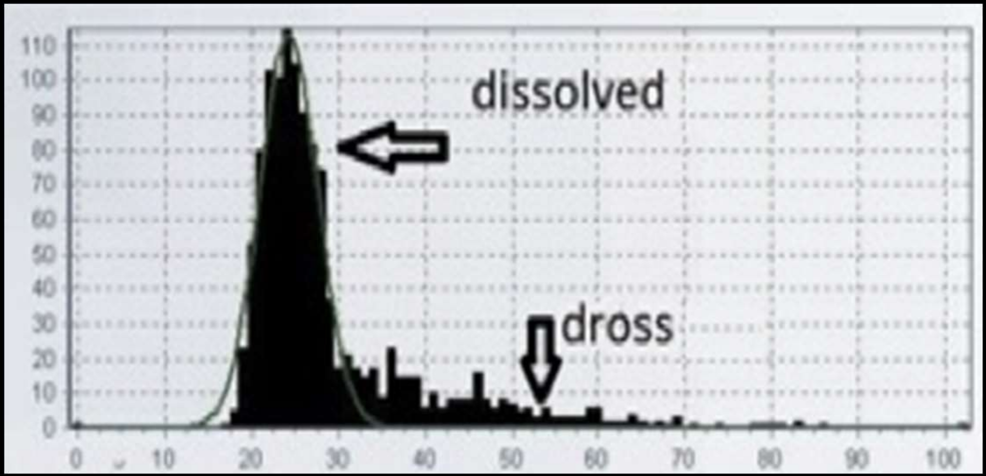




3 Real-time dross monitoring

Dross will appear as signal with high intensity in the Galvalibs intensity histogram

The Galvalibs allows you to monitor the level of dross in the pot in real-time

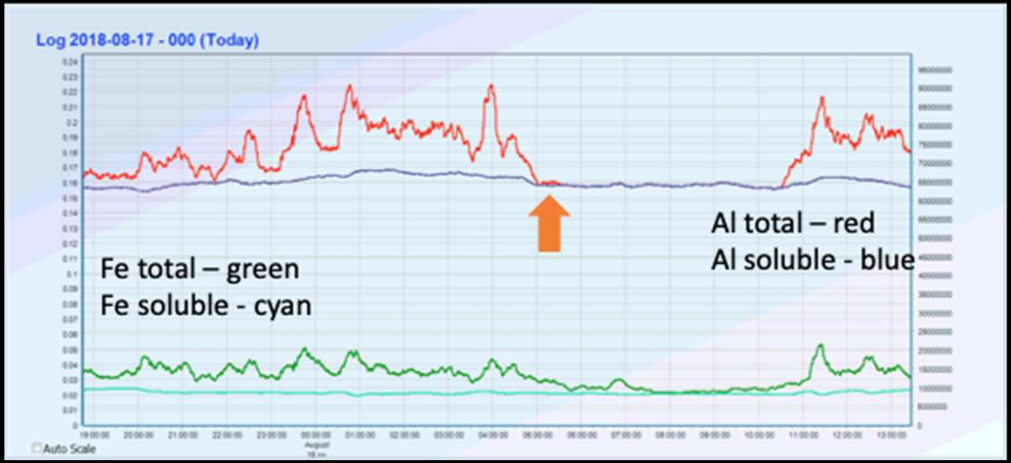


Dross event cause by ingot additions

- The solid fractions of Al and Fe in pot are very sensitive to abrupt ingot additions.
- Dross appears well before the effect on soluble Al is observed.
- Suggest primary cause of the dross overshoot is not the impact of Al on the solubility of Fe but rather the thermal shock consequent to dropping an ingot in the bath.

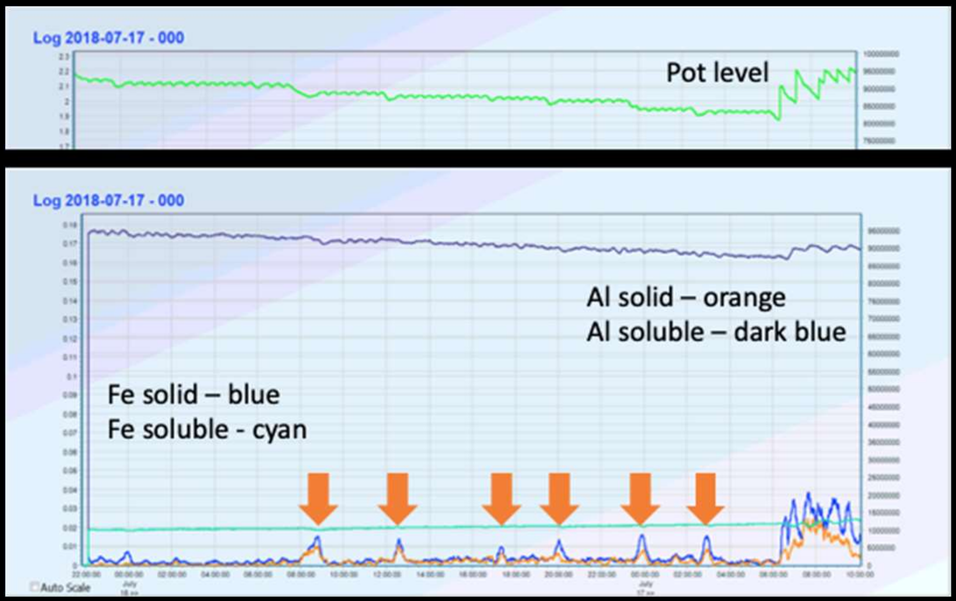
Dross event cause by ingot additions

- As soon as the line is stopped, as seen as a flat section in the pot level reading, dross quickly floats out of the bath.
- Explaining why high quality production requires slow line speed.



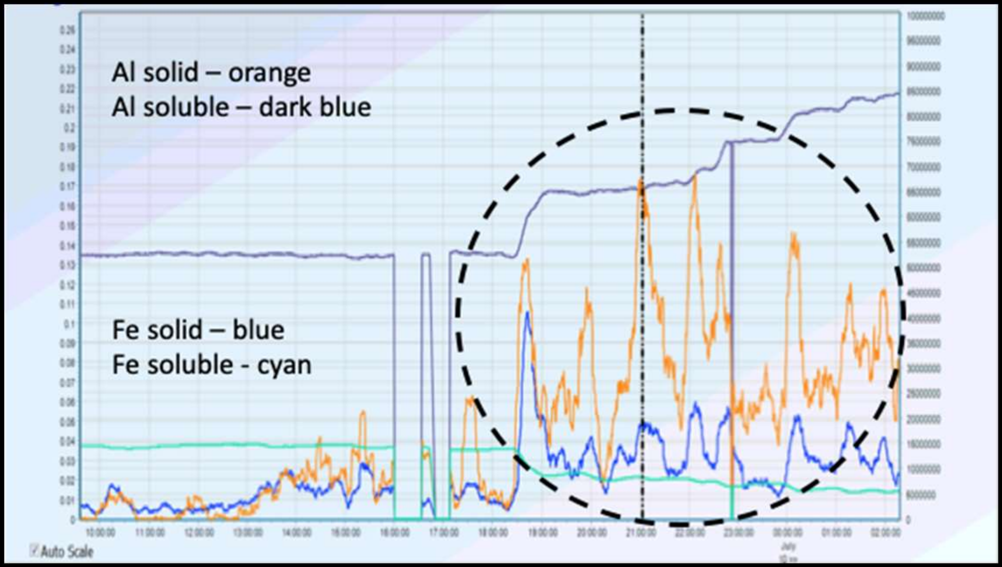
Dross caused by temperature oscillations and skimming actions during line stops

- When a line stops for a prolonged duration, the inductors are fully responsible for temperature stability.
- The pot temperature then oscillates depending on control loop of the inductors, as observed in the small oscillations in the pot level .
- Even a small temperature decrease will precipitate Al and Fe that will automatically float out (GI) or sink (GA).
- In the case where there is a source of Fe (strip in the pot, residual bottom dross, iron submerged pot equipment), this cycle will decrease the soluble Al indefinitely. In this example, Al starts at 0.176% and ends at 1.62% over 28 hours just because of this phenomenon.



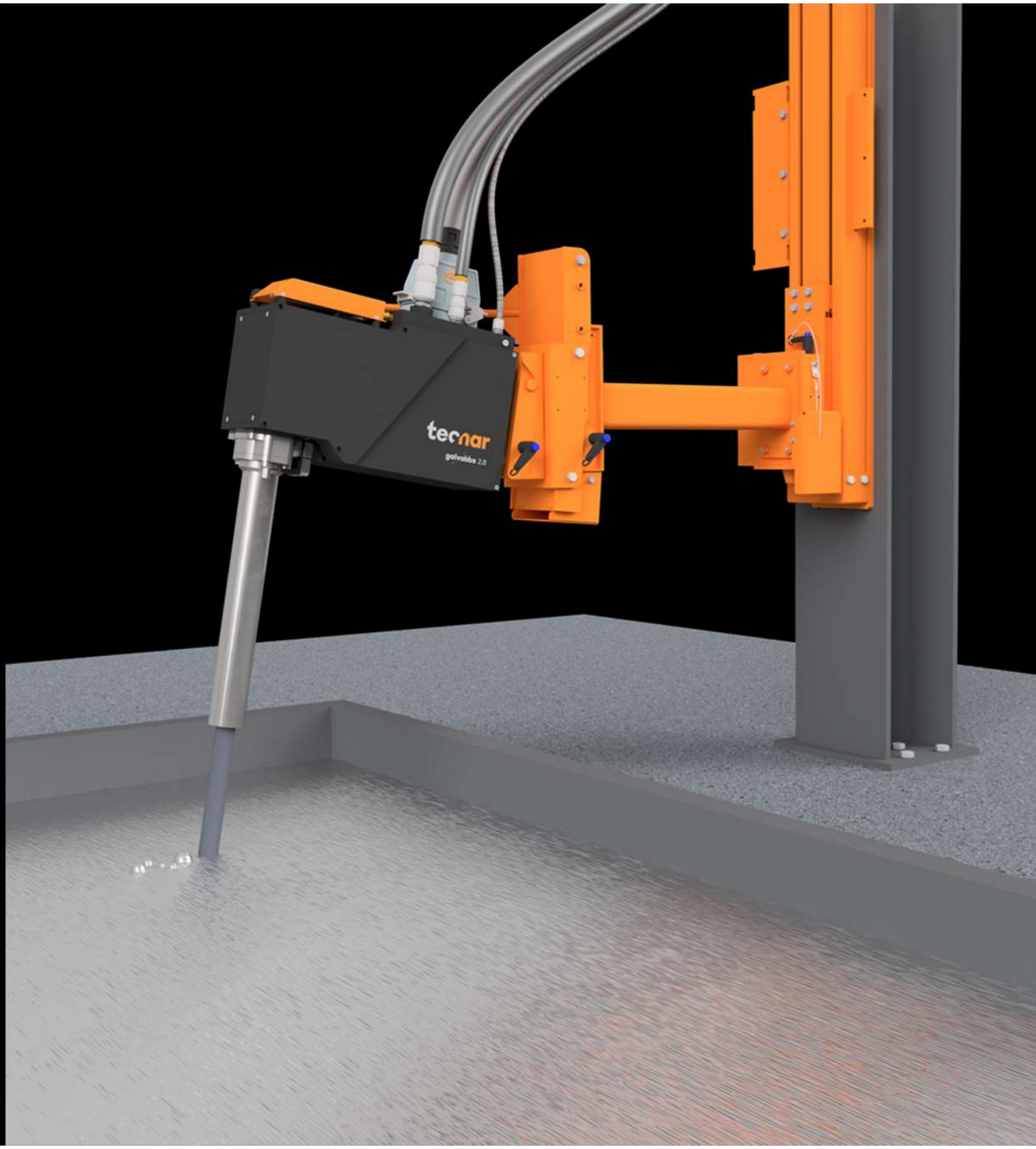
Dross caused by aluminum composition change

- An increase in Al will induce a decrease in Fe solubility, thus precipitating a very large amount of dross in the pot.
- The amount of dross generated by such a transition is an indicator of how much bottom dross was present at the time of the transition



How does pot level measurement works

1. A ceramic lance is plunged underneath the surface of the melt
2. An argon flow is maintained in the lance to prevent metal from rising in the lance
3. The pressure inside the lance will change as function of the depth of the tip of the lance

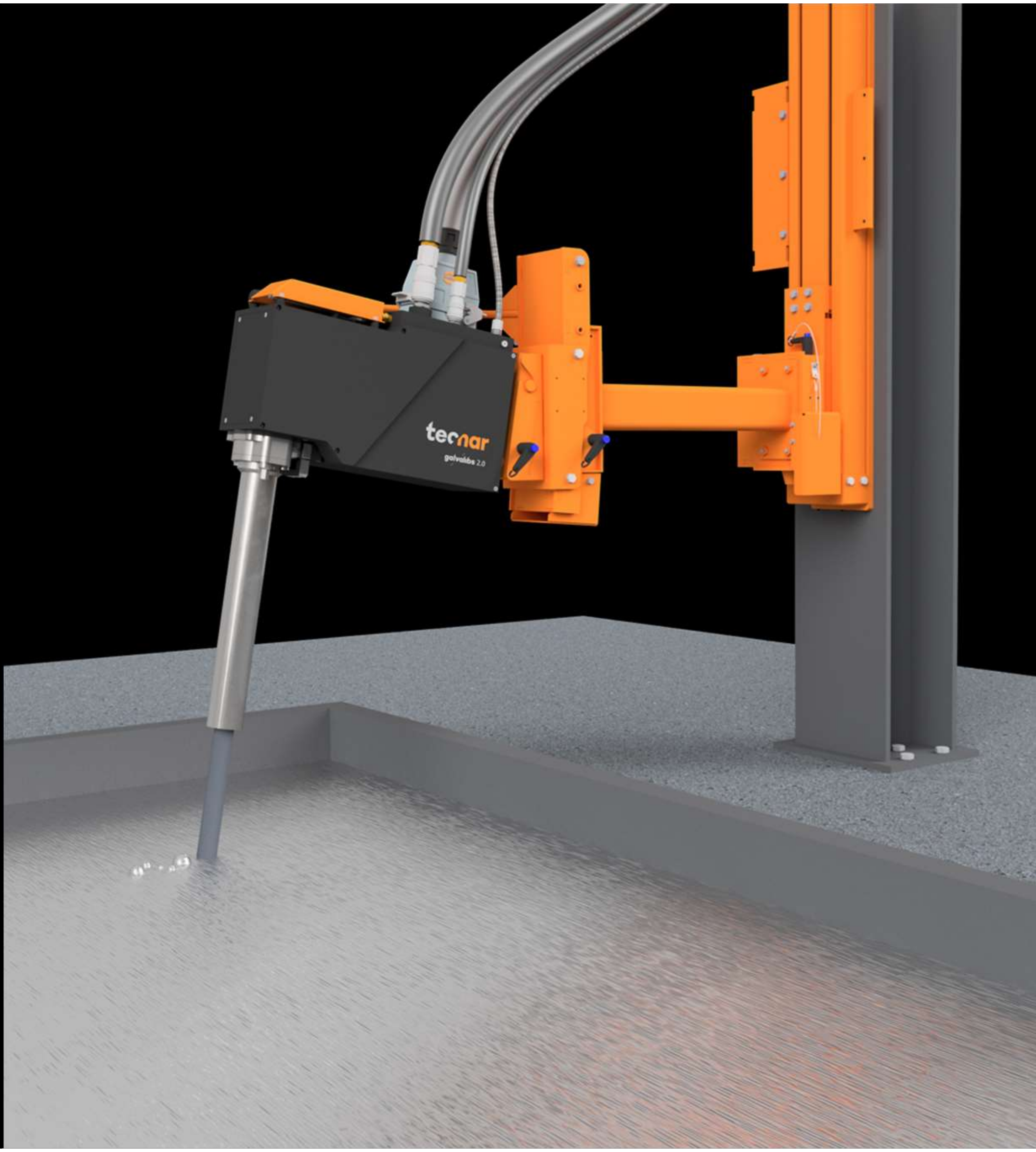


How does pot level measurement works

4. Recording of the pressure give an accurate measurement of the depth of the lance

5. NO IMPACT on the measurement from the presence of dross on surface or from skimming activities

6. Accuracy of better than ± 0.4 mm



Pot level control using the Galvalibs

Data from Galvalibs can be used to directly control the insertion of zinc in bath

Automated feedback control of the pot level

Ingot additions

Pot level monitoring using Galvalibs

Data from Galvalibs can be used to only monitor the insertion of zinc in bath when no active feedback is available

The key features

True real-time chemistry

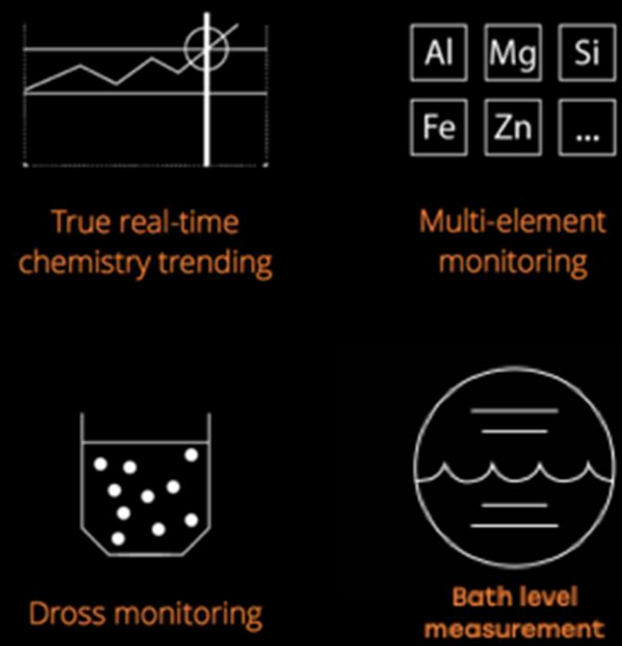
- No need to wait for lab report.
- React immediately when chemistry is drifting.

Multi-element monitoring

- Wide range of elements

Dross monitoring

Bath level measurement



The key features

True real-time chemistry

Multi-element monitoring

Dross monitoring

Bath level measurement

Operator friendly interface

- Full access to all data, user selected
- Simple one—step calibration

The key features

True real-time chemistry

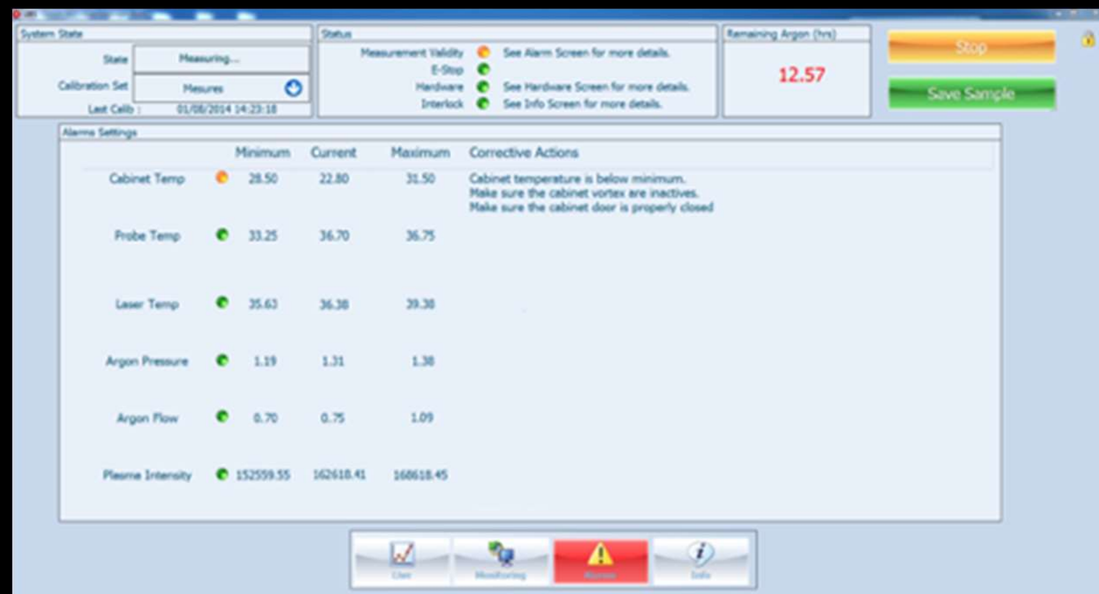
Multi-element monitoring

Dross monitoring

Bath level measurement

Operator friendly interface

- Full access to all data, user selected
- Simple one—step calibration
- Intuitive troubleshooting interface



Galvalibs™ technical specifications

Chemistry	
Soluble Aluminum	**0.020 wt% to 55.0 wt%**
Soluble Iron	**0.008 wt% to 3.0 wt%**
Soluble Magnesium	**0.001 wt% to 6.0 wt%**
Soluble Silicon	**0.001 wt% to 15.0 wt%**

Chemistry accuracy	
Relative standard deviation	**0.5% - RSD**
Relative 30-day drift	**< 1%**

Pot Level Measurement	
Accuracy	**±0.4 mm - RSD**

Data acquisition rate	
Sampling rate	**1 Hz**
Rolling average	**10 to 30 minutes**

Galvalibs™ technical specifications

Process Type	Monitored Elements	Min. typical concentration	Max. typical concentration	Middle Range Accuracy
GI	Aluminum	0.150%	0.700%	0.002% @ 0.200%
	Iron	0.080%	0.012%	0.001% @ 0.010%
GA	Aluminum	0.100%	0.140%	0.0012% @ 0.120%
	Iron	0.020%	0.032%	0.001% @ 0.026%
Zinc Aluminum Magnesium	Aluminum	1.0%	12.0%	0.06% @ 6.5%
	Iron	0.01%	0.05%	0.001% @ 0.03%
	Magnesium	1.0%	6.0%	0.03% @ 3.5%
Alu-Si	Iron	1.0%	3.0%	0.02% @ 2%
	Silicon	8.0%	12.0%	0.1% @ 10%
Galvalume	Iron	0.3%	0.7%	0.004% @ 0.5%
	Silicon	1.0%	1.6%	0.013% @ 1.3%
	More elements like Titanium, Magnesium and Calcium may be measured in Galvalume. Such applications are optimized on a per client basis.			

galvalibs around the world

AK Steel – Dearborn, U.S.A	1 unit – GA/GI
ArcelorMittal – Calvert, U.S.A.	1 unit – GA/GI
ArcelorMittal – Cleveland, U.S.A	1 unit – GA/GI
ArcelorMittal – DOFASCO, Canada	1 unit – GA/GI
ArcelorMittal – Liège, Belgium	1 unit – GA/GI
ArcelorMittal Valin – VAMA, China	2 units – GA/GI/Al-Si
Baotou iron and steel – China	1 unit – GA/GI
Benxi Steel – China	1 unit – GA/GI
BNA – China	1 unit – GA/GI
Hyundai Steel – South-Korea	2 units – GA/GI
MaaSteel – China	2 units – GA/GI

galvalibs around the world

POSCO – South-Korea	1 unit – GA/GI
Pro-tec Coating – U.S. Steel, U.S.A	2 units – GA/GI
Rizhoa Steel Co – China	1 unit – GA/GI
TAGAL Chongqing – China	1 unit – GA/GI/Al-Si
TAGAL Dalian – China	1 unit – GA/GI/Zn-Al-Mg
Tata Steel – Kalinganagar India	2 units – GA/GI/Zn-Al-Mg
Tata Steel – Liège Belgium	1 unit – GA/GI
Tata Steel – Lianwerk UK	1 unit – GA/GI
Undisclosed – Japan	2 units – GA/GI
VoestAlpine – Austria	5 units –GA/GI/Zn-Al-Mg
TOTAL	**29 units**