

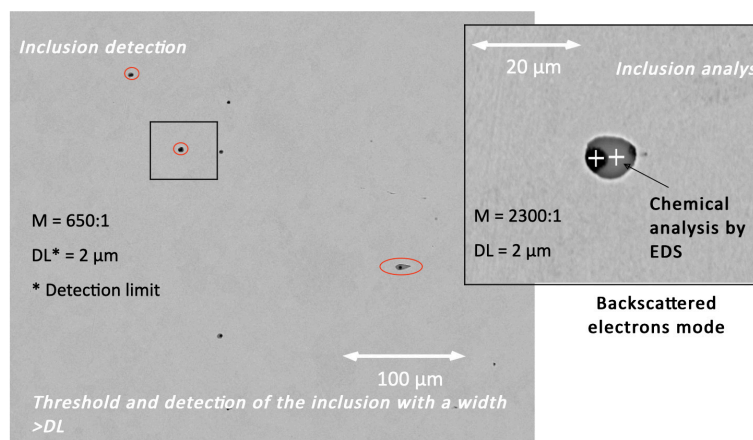
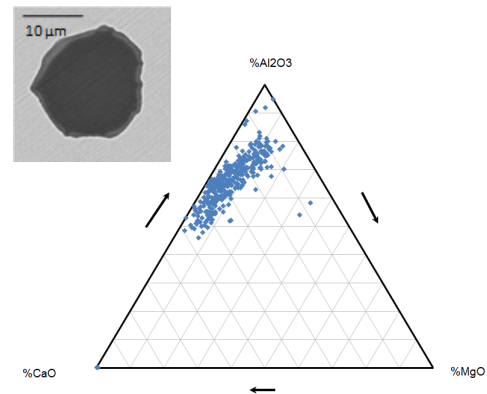
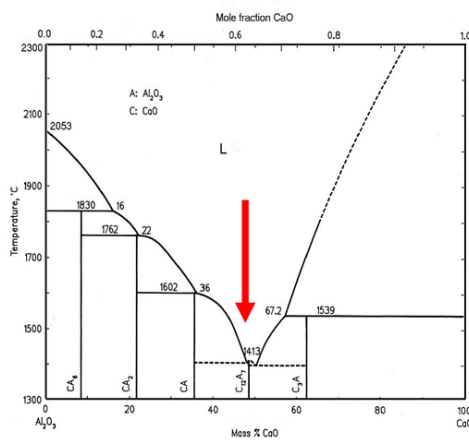
Affival can enhance your process performance by applying the technological innovation of cored wire across a wide range of metallurgical needs. Our world-class engineers and scientists provide steelmakers with access to unsurpassed expertise in primary and secondary metallurgy. As a result, our customers achieve consistent metallurgical treatment while decreasing cored-wire consumption.

Application

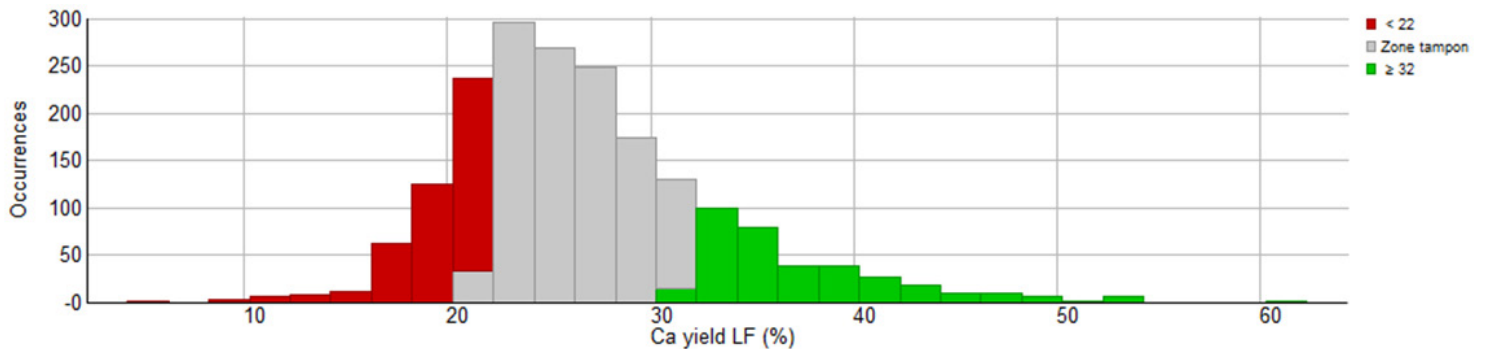
- Engineering support in secondary steelmaking for cored-wire application
- Technical support in secondary metallurgy assistance for Ca treatment, trimming, and other treatment additions
- Technical support in raw materials selection and control

Description

- Statistical analysis of the secondary metallurgy process databases
- Chemical equilibrium simulation (dedicated thermodynamics software)
- Chemical & physical analysis
- Automatic SEM analysis of micro-inclusions in steel



TECHNICAL & METALLURGICAL Assistance



A statistical analysis of the secondary metallurgy process databases enables Affival to determine the best conditions for metallurgical treatment while taking into account the unique problems each customer faces. This in-depth analysis is completed through on-site process monitoring by the Affival team.

Injection conditions are an essential consideration in monitoring a plant's treatment process.

Affival employs dedicated in-house simulation software that was developed as part of a Ph.D. thesis on Ca treatment. These studies have shown the significant improvement is possible by optimizing the feeding of cored wire into the steel bath and fine-tuning the releasing depth of active elements into the ladle.

Affival **HDx™** calcium cored wires provide metallurgical assistance in reaching a better understanding of the Ca treatment performance. This knowledge leads to cost-savings (reduced wire consumption), safety improvements (Ca reactivity), and stability (reduction of clogging risks and a more stable process).

Using thermodynamic simulation software, we can estimate the fraction of the liquid phase in inclusions at casting temperature to predict steel castability, as well as the effect of Ca content or temperature shift on micro-inclusions chemical composition.

Automatic SEM/EDS analysis of micro-inclusions populations in steel can check the efficiency of Ca treatment (chemical reaction between Ca and inclusions) while taking into account the customer's secondary metallurgy process. Affival can also analyze end-product samples upon request.

Affival's innovative tools helps analyze nonmetallic-inclusion populations in terms of number, size, chemical compositions of inclusion phases, and spatial distribution of inclusions.

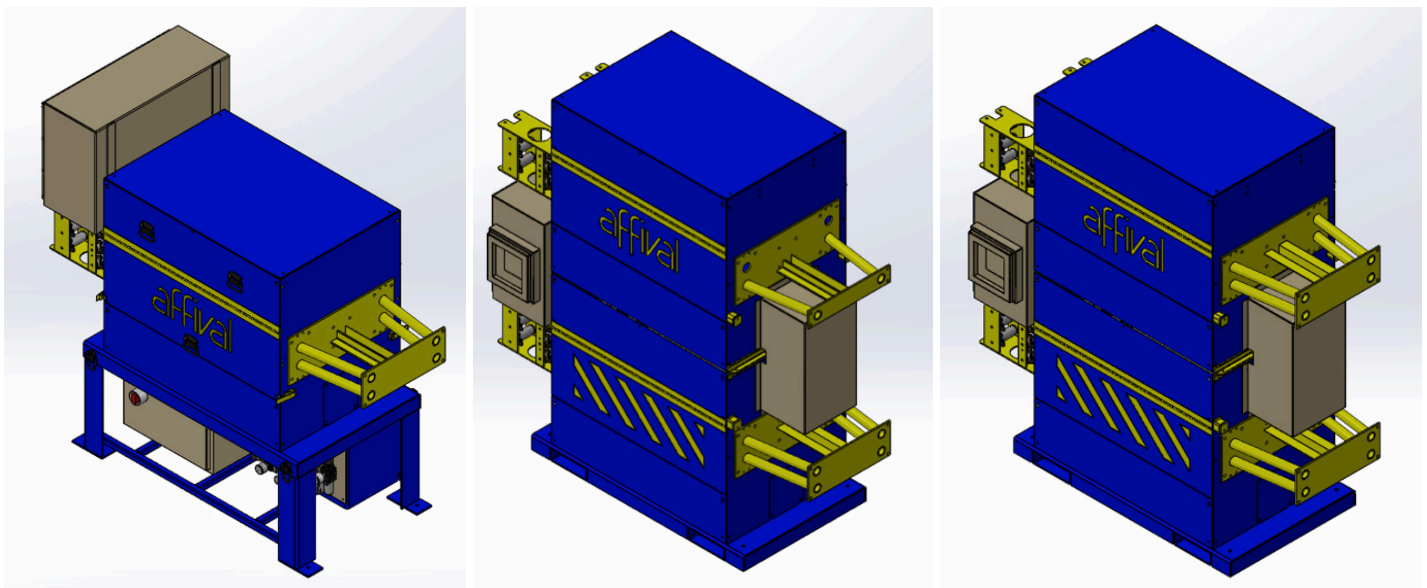
We deliver results in many formats (comparison of number and size of inclusions, ternary diagrams, standard methods) in a full evaluation report.

CORED WIRE Feeding Solutions

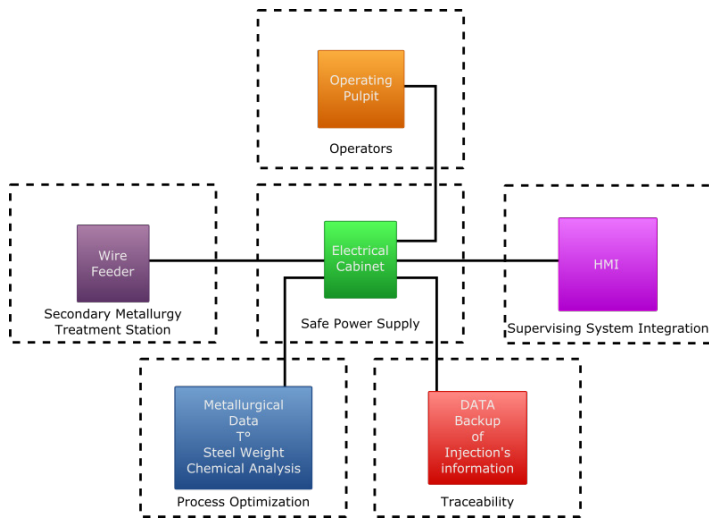


Affival is the global leader in cored wire manufacturing and also provides state-of-the-art equipment. We understand that feeding equipment is just as important as the product itself and we will work closely with every customer to integrate our feeders into their specific application.

- Affival has engineered, manufactured, and installed over 1,000 versatile machines for steelmaking, foundry, and copper industry applications.
- We can provide a wide range of different feeder options – from delivered ready-to-use to highly customized applications.
- Our team will provide full layout details including detailed engineering for guiding systems and basic engineering for support structures.
- Affival offers maintenance services and also supplies spare parts.



Product Range	Lines Qty.	Industry	Customization	Speed Range	Performance
PRECISION	1 or 2	Foundry	Yes	0-250 feet/min	High
PERFORMANCE	2, 4, 6, or 8	Steel	Yes	150-1,200 feet/min	High



AUTOMATION

Automation is the key to modern manufacturing. We engineer every component for simple, safe, and efficient operation. Call us today to help you complete your next melt shop project.

ENGINEERING

Our dedicated and experienced engineers create designs that produce high reliability and consistency. Our scope of service includes:

- **Design and manufacture**
 - Wire feeding systems
 - Low-friction guide tubes
 - Telescopic guide tubes
- **Integrate**
 - Lifting/turning tables
 - Guide Rollers
 - Other customer design requirements
- **Manage** projects alongside third-party engineering companies
- **Partner with customer during the commissioning** of our equipment to include training
- **Supply spare parts** for our wire feeders

Affival always considers the process, safety standards, and operators' needs in order to support each and every installation. Our experienced team will ensure your wire-feeding equipment is the best in the industry and that your cored wire application process is fully optimized.

RELIABILITY

Robust design and topnotch components ensure consistency and extended equipment life.

CONSISTENCY

PLC control (programmable logic controllers) create products with unmatched accuracy.

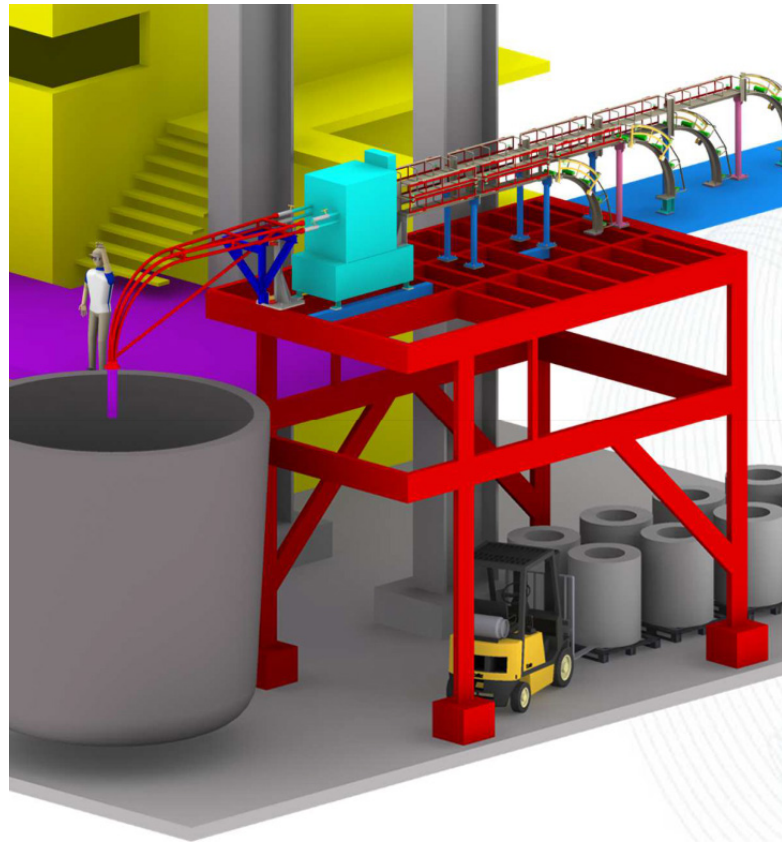
PRECISION

Length measurement, speed control, and adaptive design is the key for best results.

ADAPTATION

Customization is the core of our business; we meet each customer's unique requirements.

It is possible to combine features from several wire feeders to extend the capacity of the equipment to meet your unique specification.



CORED WIRE Ferroalloys

affival[®]
An OPTA Group Company

Affival is globally renowned as the leader in cored wire manufacturing. Our innovative products and state-of-the-art equipment designs demonstrate 20% improvements in recovery compared to standard cored wire setups. This performance advantage is especially useful for additions of expensive Ferroalloys.

Ferroalloys are beneficial to steelmaking because they have lower melting ranges than pure elements and are easily added to liquid steel. The two broad categories of ferroalloys are Class-I (with melting points below the temperature of liquid steel) and Class-II (melting points higher than the liquid steel temperature).

The ease in which a powder is added to liquid steel is known as the alloy's dissolution kinetics. The dissolution kinetics of ferroalloys depend strongly on their melting temperature ranges, particle sizes, and the convections within the liquid bath.

Compared to bulk additions, Affival cored wire allows for faster ferroalloy dissolutions, increased yields, improved consistency, more precise additions, and reduced material consumption.

Type of product:
Ferro-Alloys
including all grades of:
**Mn, Si, Cr, Ti, B,
Nb, V, Mo, etc.**
Some products also
available with N2 options

Metallurgy:
**Alloy additions,
nitriding,
trimming**

Ti

Affival ferroalloy cored wires allow for precise and energy-efficient trimming additions to meet each customer's chemical specifications.

Class-I ferroalloys:

Ferromanganese, Ferrosilicon, Ferrosilicon RE, Ferrochrome.

V

Class-II ferroalloys:

Ferroboron, Ferrotitanium, Ferroniobium, Ferrovandium.

Nb

Titanium (Ti), vanadium (V), and niobium (Nb) are durable carbide and nitride formers which are added to steel for strengthening and grain refining. Moreover, Ti and Nb treatments also reduce sensitivity to intergranular corrosion in austenitic stainless steels.

Fe

Adding V and Nb ferroalloys is common during the early stages of refining because of their high melting temperatures and recovery benefits.

CORED WIRE Ferroalloys

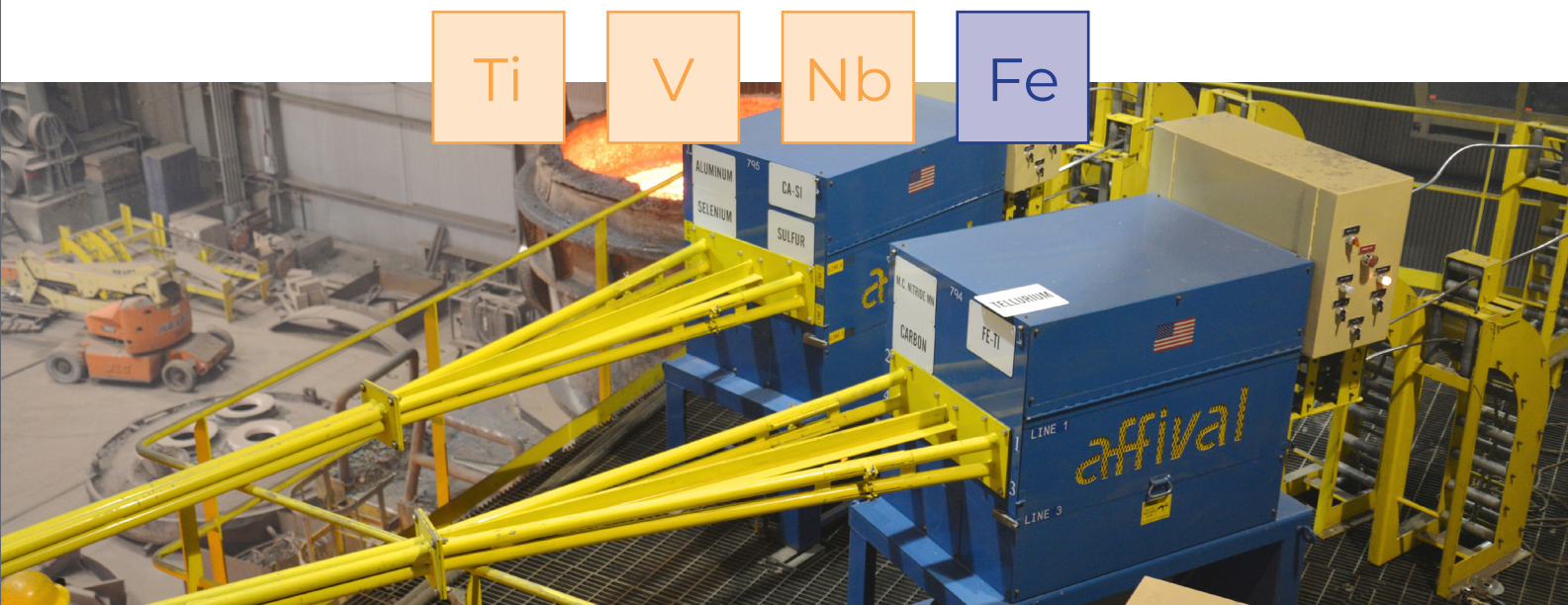
Affival can manufacture coils either horizontally or vertically depending on the design of the facility. Coils are connected to allow for non-stop wire injection. Packaging options include coil size, pallet type, protective wrapping, and reels.

Some of common product examples include:

Product	FeTi	FeV	FeNb
Wire diameter* (mm)	9.4 mm, 13.6 mm, 16.8 mm, 21mm	9.4 mm, 13.6 mm, 16.8 mm, 21mm	9.4 mm, 13.6 mm, 16.8 mm, 21mm
Melting point (pure element)	1688°C 3070°F	1890°C 3434°F	2469°C 4476°F
Melting range (ferroalloy)	1070-1130°C 1958-2066°F	1660-1740°C 3020-3164°F	1535-1630°C 2795-2966°F
Effect on steel	Grain refining Strength Toughness	Grain refining Strength Wear resistance	Grain refining Strength Corrosion resistance

* Other wire diameters are available upon request.

** Variations and customizations to these common products are also available.



Affival
210 14th Street & 3rd Avenue
New Kensington, PA 15068
www.affival.com



HDx™

Ca (Pure Calcium)

affival®
An OPTA Group Company



The “thermos” design behind Affival HDx cored wire allows calcium to react deeper in the ladle for the most cost-effective results and superior inclusion morphology.

Our unique casing consists of an inner steel strip wrapped in paper insulation and an outside steel casing. The insulating layer allows for a deeper penetration of calcium into liquid steel, which **increases Ca recovery** while reducing reactivity compared to conventional pure Ca or Ca-mix cored wires.

Affival HDx™ wires offer the best alternative between solid calcium treatments and traditional Ca-mix cored wires. Affival developed HDx™ through extensive research and extensive field treatment experience. The data demonstrated that HDx™ wires enable reliable penetration and assimilation into liquid steel while preserving secure wire handling.

With pure-calcium cores, our versatile HDx™ wires have a steel sheath and an insulation layer which contributes to **higher and more consistent recoveries**. The wires require only routine handling and provide unlimited cage to cage connectivity.

Calcium treatment of liquid steel is crucial to transforming solid alumina inclusions into liquid calcium aluminates. The resulting modification of composition and morphology of oxide and sulfide produces several advantages, including:

- Improving steel castability through reduction of nozzle clogging resulting from aluminum deoxidation
- Globularization and dispersion of oxide and sulfide inclusions to improve steel ductility and strength
- Improvement of steel cleanliness by removing alumina inclusions from the bath
- Reduction of inclusion-related surface defects in billet, bloom, and slab castings
- Prevention of inclusion formation during solidification

Type of product:

Pure Ca

Metallurgy:

Ca treatment

Melting point (Ca):

839°C / 1558°F

Boiling Point (Ca):

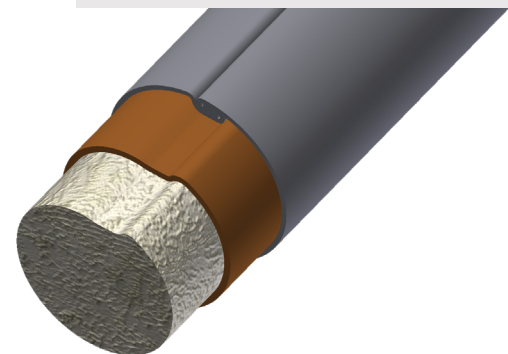
1484°C / 2703°F

Density at 20°C:

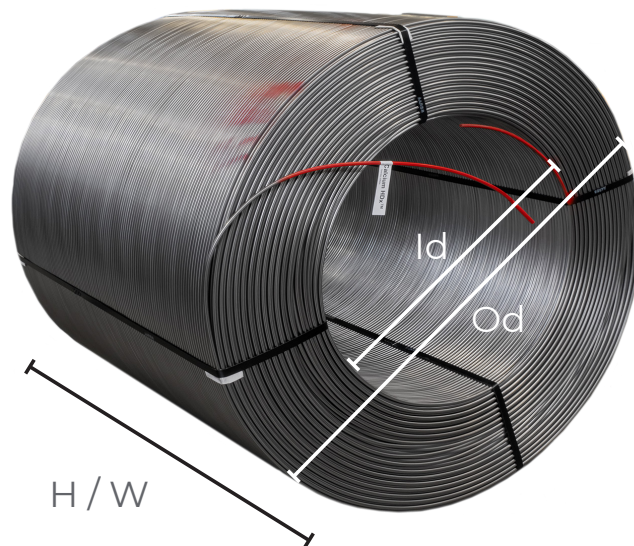
1.53 g/cm³

Percentage of Ca:

98.5-100%



Affival can deliver coils either horizontally or vertically, depending on the injection setup. Coils are connectable for non-stop injection. Packaging includes multiple options for coil size, pallet type, protective wrapping, and reels.



HDx™ Product	A Cage	J Cage	W Cage
Wire diameter (mm)	9.5; 10.8	9.5; 10.8	9.5; 10.8
Calcium metric weight (g/m)	70; 85	70; 85	70; 85
Outside diameter (in)	44	44	52
Inside diameter (in)	20	20	29
H / W: Height / Width (in)	29	46	45