Supplying Innovative Processes, Equipment and Service to the Metallurgical Industry
Uvån Hagfors Teknologi AB is an engineering company with the ambition to contribute with processes based on in-depth metallurgical know-how. We concentrate our activities to Granulation technology for metals and to Converter refining technology.

Although the company itself has been operating as an independent company since 1989, the history dates back and integrates process development related to the Swedish steel industry over centuries.

The company name Uvån Hagfors Teknologi AB derives from the river Uvån which streams through the town Hagfors. The place is in the heart of an area called “Bergslagen” which is the very cradle of the iron and steel industry in Sweden. The long tradition of steel industry has formed an environment where innovations based on in-depth know-how and integration of new inventions in own production have been allowed to blossom.

It is with great pride we carry this tradition into the future. A future where not only productivity and short sighted goals are the ambitions, but equally important is care for the nature we all share.
Granulation of Metals

UHT has developed a process – **GRANSHOT®** – for quick solidification of metals in water. The process is used in ferroalloy-, iron- and steel- industries. In the process liquid metal is split up – granulated – into droplets which are rapidly quenched in water. The metal is cast directly from liquid metal to ready-to-use bulk material without any crushing and sieving steps.

Granulation is often performed with great metal flows (up to 250 tons/hour per production unit for iron). The granulated product is very suitable for use in numerous metallurgical/steel making operations.

Refining of Stainless Steel and Ferroalloys

UHT offers equipment and process control systems for refining of stainless steel and ferroalloys. Based on in depth metallurgical knowledge, complete equipment and process is designed for every special application.

The **CLU®** converter process, which is a further development of the AOD process, is the most flexible process for stainless steel and ferroalloy refining. Through the use of steam as an additional process gas all grades of stainless steel can be produced with low argon consumption, high productivity and low refractory wear.

Process Control Systems

Our modern process control systems, based on advanced metallurgical process models, are delivered as integral parts of our technology packages or can be implemented separately to improve control of already existing production equipment.

The **UTCAS®** Converter Automation System is a suite of highly sophisticated computer system modules specially designed and developed for converter refining processes.
GRANSHOT metal granulation

The granulation principle is based on a heat exchange between the liquid metal and the cooling water. There are no fundamental variations in the process whatever type of metal to be cast.

The liquid metal stream, normally poured from a tundish or ladle, strikes the refractory sprayhead placed in the centre of the Granshot granulation tank. The sprayhead splits the metal stream into droplets (granules) that are distributed evenly over the granulation tank water surface.

Cooling takes place as the granules sink downwards in the granulation tank exchanging heat with the counter flowing cooling water.

The solidified granules are discharged from the lower end of the tank by the unique UHT air/water ejector on to a dewatering screen. After dewatering the granules contain less than 1% water. From the dewatering unit the granules are transported via conveyor belt to the storage area, or fed into a rotary dryer (common route for ferroalloy granulated products).

The metal flow in the process is more or less straight forward where the product usually flows freely between units. Depending on site preferences the plant configuration may be altered in numerous ways.

Below a schematic description of the Granshot process is shown.
Granulation of Ferroalloys

The Granshot granulation process is very suitable for granulating ferroalloys and is today used as a standard operation for many ferroalloy producers. Most metals are suitable for granulation but ferroalloys granulated today are mainly FeNi, FeCr and FeSi.

To secure a high yield and a minimum of scull formation it is common to granulate at relatively high flow rates (normally in the range 1-2.5 tons/min for ferroalloys) depending on the preconditions for the particular plant. This is due to that most ferroalloys are tapped from the furnace at a temperature close to the liquidus temperature.

The granulated ferroalloy product

The granulated ferroalloy is an attractive alloying material to be used in any metallurgical process. The granules show properties such as chemical homogeneity, minimum oxide content and low content of fines. The size and shape of the granules result in excellent feeding properties, which in turn govern compact storage, easy handling and precise dosage.

The Granshot process offers a practical and economical way of handling the liquid metal for the ferroalloy producer. The process is run at a low cost, considering both operation and maintenance and the metal yield is close to 100 %.
Granulation of Iron

Granshot in integrated steelmaking
The Granshot granulation system is a method for converting liquid metal into granules by rapid granulation in water.

In integrated steelmaking the Granshot process is used as a back-up facility to handle excess iron (or steel) whenever downstream facilities are down, producing Granulated Pig Iron (GPI®) or granulated steel.

The Granshot plant decouples the pacing of the ironmaking and steelmaking units allowing the ironmaking unit to continue to operate at peak performance at all times. Besides an increased iron output, more stable iron making conditions result in other operational benefits. The pig iron composition and temperature variations are reduced which decreases the steelmaking operational costs.

High capacity granulation
The Granshot equipment is designed for granulation of large batches of liquid metal at a rate of up to 250 tons/h per production line. These high metal flows are handled by the specially designed metal and water distribution systems in the granulation tank.

Multiple choices for plant configuration
The Granshot plant is compact and only requires a plant footprint of approximately 15x10 m spanning from ladle tilting device to product discharge on conveyor belt. The Granshot configuration is tailor made for each application.

Several different alternatives are possible:
• Granulation from ladle in ladle-tilter via tundish
• Granulation from ladle in turret via tundish
• Granulation from torpedo via runners and tundish
• Granulation from ladle hanging in crane via tundish
• Granulation directly from furnace via runners and tundish

The different configurations make it possible to design the plant based on the existing preconditions at site in order to achieve the best logistical solution for each production case.

GPI® - the product
The Granulated Pig Iron (GPI) is a prime iron product with excellent properties for internal use in many metallurgical/steel making operations, or for sales to external customers.

Some typical characteristics of the GPI:
• Homogeneous composition
• Very low oxide content
• High metallic yield (close to 100%)
• High bulk density (~4000 kg/m3), depending on size distribution
• Excellent preheating properties and fast melting/dissolution when added to metallurgical process
• Inert during shipping and storage
• The granule shape (deformed spherical) is excellent for raw material handling with conveyor belt, magnet, front-end loader, bin systems and scrap skip.
Granulation of Iron

Product discharge.

SSAB GPI
Low Sulfur Granulated Pig Iron
The High Quality Raw Material

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Refining of Stainless Steel

UHT has been involved in stainless steel production for more than 30 years. Significant contributions have been made over the years from in-house production experiences in development of complete systems for refining of steel in converters, ladle treatment plants and EAF’s. UHT offers complete converter equipment and process control systems for refining of stainless steel. The equipment design is based on our vast experience from the steel industry.

A converter plant is designed based on the process concept involving local conditions, planned product range, market conditions etc. UHT has developed an advanced computer program for process design where any kind of process alternative can be simulated and optimized. Based on the prerequisites the design tool is used to give all necessary data for the plant design.

CLU converter process

The CLU converter process, which is a further development of the AOD process, is the most flexible process for stainless steel refining. Through the use of steam as an additional process gas all grades of stainless steel can be produced with low argon consumption, high productivity and low refractory wear.

Reasons for using steam

The fundamentals of using steam in the converter lie in the reduction of steam. The effect of steam is twofold. When superheated steam is introduced in the converter it is decomposed into oxygen and hydrogen. The formed hydrogen gas will act as an inert gas to replace argon or nitrogen while the oxygen will take part in the carbon oxidation. Hence by using steam the consumption of the more expensive argon gas can be reduced. This can lead to considerable cost savings depending on the amount of steam introduced. Use of 1 kg of steam substitutes 1.25 Nm3 Ar (or N2) and 0.625 Nm3 O2 in the converter.

The second effect comes from the fact that the reduction of steam consumes heat. This means an additional cooling benefit is obtained by utilizing steam in the process.

Therefore the CLU process gives a more flexible overall melting where solid material and steam is optimized to reduce cost and increase productivity (1 kg of steam replace 10 kg of scrap in terms of cooling capacity). A better temperature control and reduced refractory contact time through the effective use of steam also leads to lower refractory wear.

CLU characteristics

- Argon consumption is low
- Need of expensive coolant material is reduced
- Process control is simplified
- Lining life is high
- Process time is reduced
Converter valve station.
Refining of Ferroalloys

The CLU converter process is very suitable for ferroalloy refining. In the CLU process steam is used as an additional process gas. The use of steam makes the CLU process flexible with several benefits such as reduced consumption of high cost argon gas and possibilities for improved energy management in the converter.

Medium carbon ferrochrome and ferromanganese can easily be produced in the CLU process due to the excellent opportunities for temperature control without alloy dilution. This is a valuable feature in manganese production where temperature control is vital in order to minimize manganese vaporization. The converter process also allows for a broader product range to be made with further refined products such as low carbon ferrochrome and ferromanganese.

Based on our vast experience from the steel industry UHT offers complete converter equipment and process control systems for refining of ferroalloys. By UHT’s converter automation system, UTCAS, the process are run fully automatic. Each converter plant is designed based on the process concept involving local conditions, planned product range, market conditions etc.
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Process Control Systems

Our modern process control systems, based on advanced metallurgical process models, are delivered as integral parts of our technology packages or can be implemented separately to improve control of already existing production equipment.

UTCAS Converter Automation System

The UHT converter automation system - UTCAS is a suite of highly sophisticated computer system modules specially designed and developed for converter refining processes.

The UTCAS concept combines effective real-time process control system with advanced tools for process design and production evaluation, thereby providing the complete solution for converter process management.

The Process Design tool provides an effective instrument for designing best-practice, tailor-made process routes for each different steel grade. If required, several alternative routes for the same grade can be designed.

The real-time process control system can practically run the process fully automatically from start to end – following the pre-defined process design – ensuring that the best-practice is repeated heat after heat.

The Process Evaluation tool is used to evaluate produced heats with a focus on the effectiveness of the process being used, providing feedback for future process design.

By taking advantage of all UTCAS modules, it is possible to drastically increase productivity, improve quality and, at the same time, lower production costs.

UTCAS operator screen example.
What makes UTCAS a unique solution?

The very heart of UTCAS consists of a set of highly advanced thermodynamic and mathematical models. The models are based on the latest results from university research combined with many years of empirical trials and studies. The capacity of the models is utilized by two powerful functions – Tracking & Prediction and the Process Optimization.

The Tracking & Prediction function allows the operator to consistently follow the actual heat state as well as the final (calculated) heat state, giving great opportunities to correct problems and deviations before they arise. The process can quickly be turned back on the right track without losing time and extra costs.

The Process Optimization function makes it possible to balance the process to simultaneously meet all defined targets for steel and slag composition, steel mass, process temperature and tapping temperature. It will calculate the exact amounts of gases and materials in order to move from the given start conditions to the defined targets in the most economic way.

Before starting the process, the Process Optimization is used to generate an initial process plan based on the actual incoming composition, mass and temperature. During processing, the Tracking & Prediction and Process Optimization functions are administrated by the process control system. The Tracking & Prediction will pick up any deviation in gas or material input as well as results from sampling and temperature measurements. The Process Optimization will then re-calculate the process plan ensuring that the right corrections are made in order to meet the final targets. Both the Tracking & Prediction and the Process Optimization functions are available for simulation and evaluation purposes – by the Process Design and Process Evaluation tools. This is extremely useful when testing process changes and when designing processes for new grades.

UTCAS for simulation and training

UTCAS also offers the possibility to be used as a training studio. The system can easily be configured as an off-line process simulation environment – much like a flight simulator. Different practices can be generated and “processed” as actual heats in real-time.

The full scale environment can be used for example to simulate new practices for new steel grades or serve as a training studio for operators and engineers.

UTCAS process control system in operation at Outokumpu Stainless, Avesta, Sweden.
UHT Services and Support

Vast metallurgical experience, forefront technology and cost-saving equipment have established UHT as a reliable supplier of metallurgical products, innovative processes and advanced control systems to the iron, steel, ferroalloy and foundry industries worldwide.

UHT supplies key equipment as well as turn-key plants. Our program includes plant and system design, engineering and equipment, installation, training of personnel and start up of equipment.

UTCAS Studio

In our UTCAS Studio in Uddeholm we have a fully operational converter process simulation environment – much like a flight simulator. In the studio different plant configurations can be emulated and various processes and operations can be defined and evaluated. Heats can be “processed” in real-time out of an operator perspective.

You are very welcome to visit our UTCAS Studio where we can demonstrate all the UTCAS facilities, simulate your own process and discuss possible improvements. We also provide full training packages including metallurgy, process design and engineering and hands on process control operation.

R&D Center

Adjacent to our workshop in Hagfors we have a small R&D center. In the R&D center we have a pilot scale granulator installed together with a 400 kg high frequency furnace. Here it is possible to make granulation trials as well as in detail study and develop the Granshot process. The R&D center will in the future also include equipment for pilot scale development of metal refining.
UHT Workshop

Our workshop in Hagfors includes a number of machining equipment and has a lifting capacity of 10 tons. Main activities in the workshop are production of spare parts for granulation and converter plants as well as assembling and testing of equipment prior to shipment.

Production of equipment in structural and stainless steel

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