

# PRODUCT PORTFOLIO

COMPETENCE IN METALLURGY AND RECYCLING



meTop



UrbanGold  
recycling for a green future



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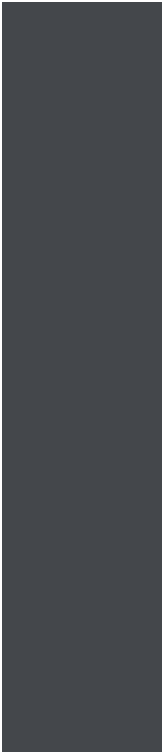
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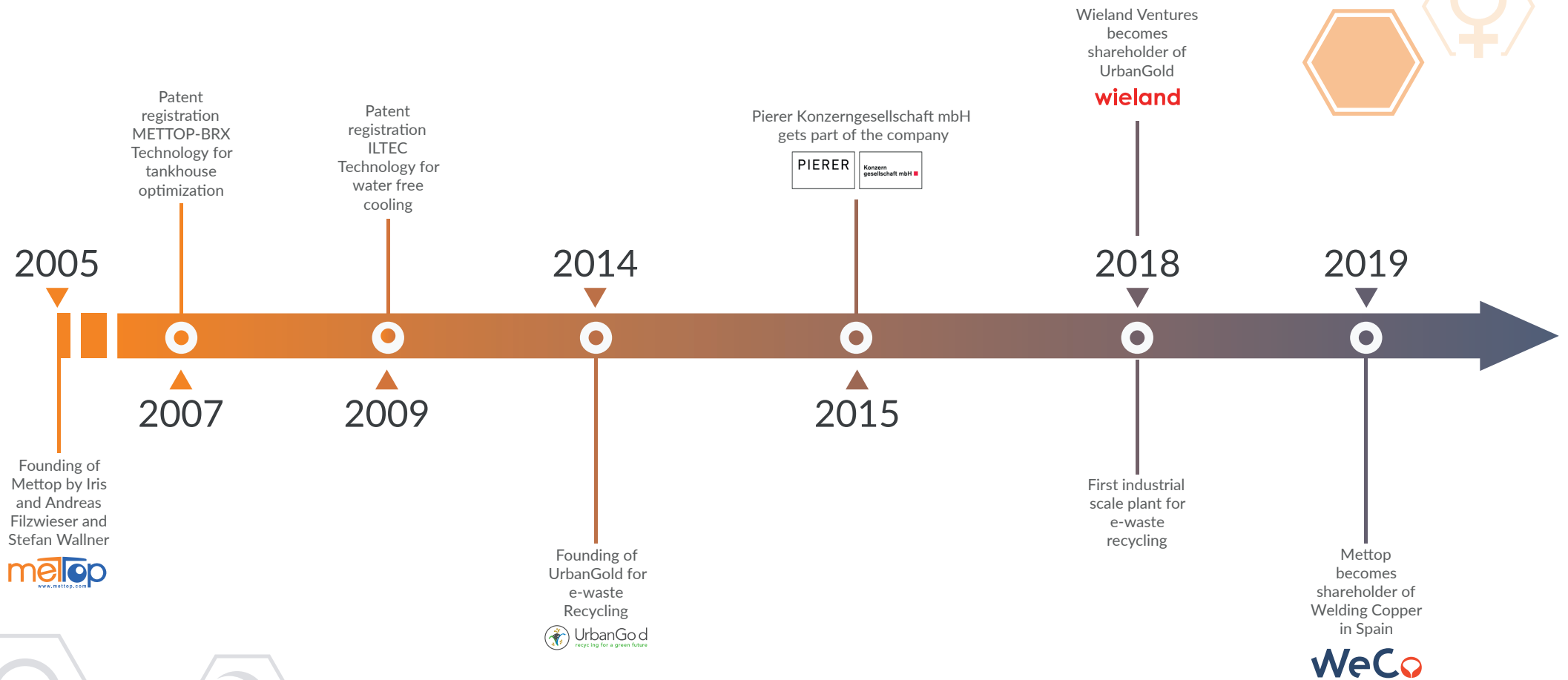


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A detailed black and white photograph of a mechanical watch movement. The image shows various gears, including a large circular gear with teeth, and several thin metal rods or levers. The background is blurred, focusing attention on the intricate mechanical parts.

# **HISTORY AND TIMELINE**









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# INTRODUCING INTERCOMPANY COMPETENCE

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When Mettop was founded in 2005, the company name was Mettop Metallurgische Optimierungs GmbH. The company was started with the goal of optimising the metallurgy process and that remains our goal today. Continuing development on the subject of metal recycling led to the spin-off of the UrbanGold company in 2014. Modelling, designing, and developing processes for

the metallurgical recycling of urban raw materials is a particular strength within UrbanGold. Today we offer tankhouse solutions including delivery and construction of the entire equipment on one side and furnaces to recycle urban raw materials on the other side. The holistic approach from process understanding to process modelling and

plant engineering including refractory lining up to installation and commissioning is the focus of our engineers. Process modelling and the possibility of a mathematical description of the metallurgy is the basis for digitalisation and for online control and operation of processes and systems. Thinking beyond the boundaries of individual expertise areas and

companies is the basis for the implementation of successful projects with customers. Thinking out of the box is our credo and with this, our first intercompany brochure, we hope to share insight into our multifaceted company and the various services we provide.

Dr. Iris Filzwieser,  
Dr. Andreas Filzwieser &  
Dr. Stefan Konetschnik



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# INTRODUCTION METTOP

INNOVATIVE TEAM FOR YOUR SUCCESS

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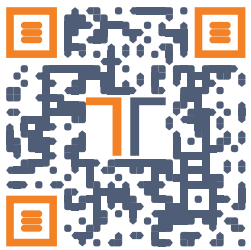
Mettop GmbH, founded in 2005, is an independent Austrian engineering company, specialised in the design, optimisation, and engineering of technologies for metallurgical processes. Mettop is active in the field of pyro- as well as hydrometallurgy of nonferrous metals and furthermore serves with innovative cooling systems for the iron and steel industry. The scope of services comprises of optimisation solutions in the

area of furnace integrity, combining refractory selection and layout, gas purging systems and cooling elements. In the field of hydrometallurgy, a new electrolysis technology - the METTOP-BRX Technology - was patented and is in operation to allow an acceleration of the electrolytic refining of up to 50 percent. For

all metallurgical plants and equipment, Mettop developed the new and water-free cooling technology ILTEC, that uses an ionic liquid as the cooling medium, to create new pathways towards safe and efficient cooling for the entire metallurgical industry. In addition, Mettop is internationally active in terms of technical consulting (process optimisation),

operator training for customers in the nonferrous metals industry, and also assists in the optimisation of risk management in metallurgical plants.





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# METALLURGICAL OPTIMIZATION AND PROCESS CONSULTING

BEING ONSITE WITH OUR CLIENTS IS THE BASIS FOR DEVELOPING NEW TECHNOLOGIES AND PROCESSES

It is not sufficient to know that something will occur – we need to know when and why. Therefore, it is important to understand the background of a process and raise awareness of the fundamental influences and interrelationships. Several well-known technologies have been developed by our metallurgists in the last few years, such as, the METTOP-BRX Technology for improving tankhouse operation, or the ILTEC cooling solution for safe furnace cooling. However, other developments like hydrogen purging or the UrbanGold processes were also driven by our group of metallurgists.

The basis for these developments is the highly educated and experienced employees, co-operations with universities and research facilities and the very close and confidential co-operation with clients.

Listening to and understanding customers' problems is the basis for fruitful and profitable cooperation. Sometimes it is important to get an outside view from an independent consultant, who is not caught up in daily work routine. Being present onsite until the end of the project is a matter of course for us. Our objective approach is to discover sustainable solutions and improvements for you and your business – starting from small optimisation projects up to complete process and facilities re-design.

“PASSION  
FOR METALS”

## CHALLENGE

- Personnel occupied with daily routine
- People are focused on established processes
- Thinking inside the box
- High staff fluctuation
- Difficult to recruit skilled and/or young people

## SOLUTION

- External experts hired for specific projects
- Thinking outside the box
- Pool of experts with interdisciplinary knowledge from related industries
- Both experienced professionals and highly educated specialists
- Close cooperation with universities and research facilities

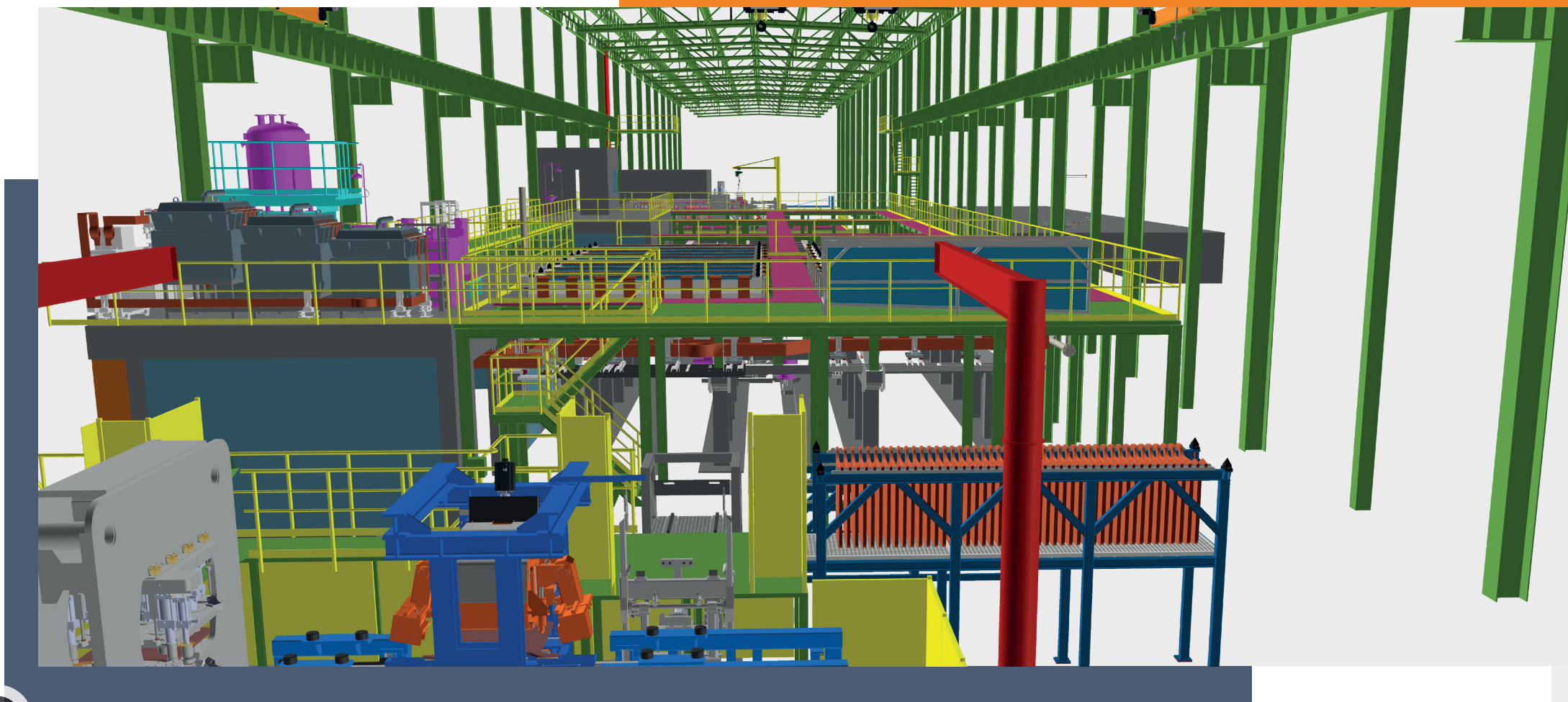
## BENEFIT

- Objective recommendations
- Relieve the on-site staff
- In depth expertise and analysis
- Gaining a rapid and thorough basis for decision making
- Confidential cooperation
- Estimate and state CAPEX & OPEX





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# TANKHOUSE

## LAYOUT, DESIGN, SUPPLY, AND CONSTRUCTION

Copper tankhouses, which are part of the primary copper production, are becoming larger and larger. Capacities of more than 400,000 t cathodic copper/a up to 1,000,000 t/a are now standard. With the help of high-current technology (Mettop-BRX-Technology), new tankhouses can be built up to 25% smaller (with the same production volume) and the stock in copper is 25% less.

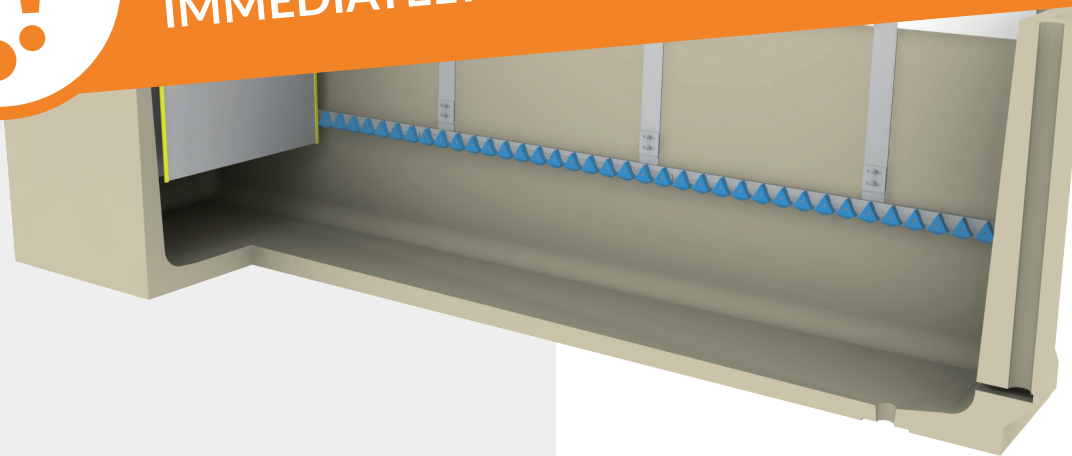
Alternatively, tankhouses in the range of 5,000 t/a to 50,000 t/a are coming up, which follow a pyrometallurgical recycling process, where the main task is to extract the precious metals from electronic scrap. In this area Mettop offers a layout and design which is individually tailored to each customer request. The offer ranges from low-cost

options to fully automated systems. The entire electrolysis is created in advance as a 3D model to enable smooth and quick installation. The complete digital mapping of the electrolysis, the anode sludge treatment, and the precious metal plant can also be provided.

Simple but very efficient measures can be implemented in existing tankhouses in order to increase current efficiency. The use of so-called "cathode spacing devices" can increase the current efficiency in each electrolysis by several percentage points. The installation is simple and can be carried out at any time.



 CALL US FOR INFO ABOUT OUR CATHODE SPACING DEVICES AND IMMEDIATELY INCREASE YOUR CURRENT EFFICIENCY FOR 3%





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# METTOP-BRX TECHNOLOGY

CURRENT DENSITY HIGHER THAN 400 A/m<sup>2</sup> -  
YESTERDAY AN ILLUSION, TODAY THE REALITY

Innovative technology means for us: Considering new directions and adopting unconventional approaches to maximise productivity and quality. In order to increase the productivity of a copper tankhouse, the current efficiency and/or current density have to be increased.

Together with Montanwerke Brixlegg AG, Mettop has developed a parallel flow device (PFD) that introduces the fresh electrolyte directly between each pair of electrodes. The device directs the fresh electrolyte in an upward flow upon the surface of the cathode, thus enhancing the existing flow through natural convection. Therefore, the settlement of the anode slime is not influenced by the use of the METTOP-BRX Technology. The PFDs are customer-tailored to guarantee optimum results for each individual tankhouse.

Possible applications are electro-winning and electro-refining, either with starter sheets or stainless steel cathodes.

Since 2012 Xiangguang Copper, China, has operated the tankhouse Nr. 2 at a current density of 420 A/m<sup>2</sup> achieving a current efficiency above 99% and is therefore Mettop's oldest reference for a copper primary tankhouse.

Even more challenging is the tankhouse based on 100 % secondary raw material operated by Montanwerke Brixlegg, Austria. Since 2011 Montanwerke has operated their tankhouse with current densities up to 410 A/m<sup>2</sup> achieving current efficiency rates above 98%.

## CHALLENGE

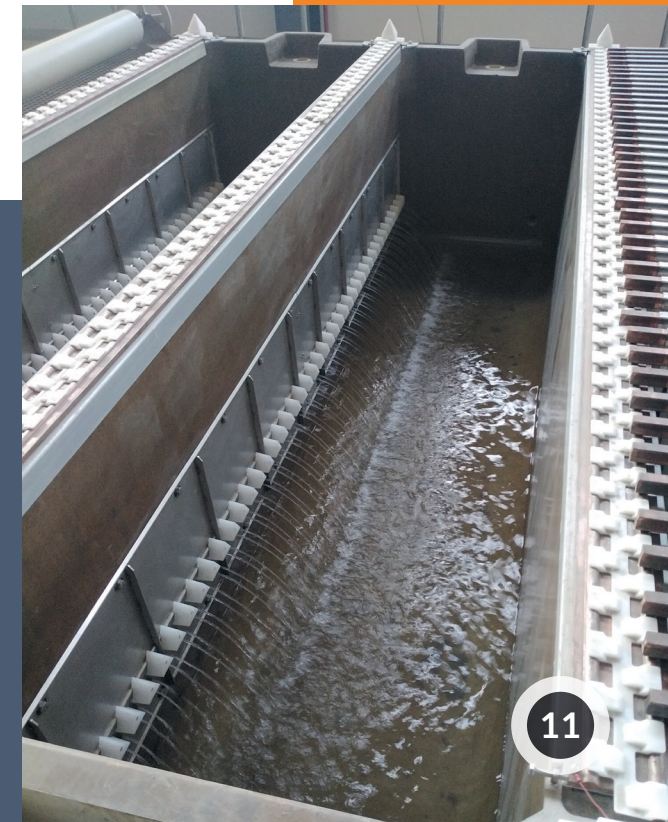
- Insufficient productivity of brown field electrolysis projects
- Demand for continuously increasing productivity
- Tankhouse as a bottleneck
- High bound capital due to long lead times
- Decreasing anode quality

## SOLUTION

- Parallel flow of fresh electrolyte
- Precise cathode alignment
- Enhanced flow of electrolyte
- Increased current density
- Optimised inhibitor distribution

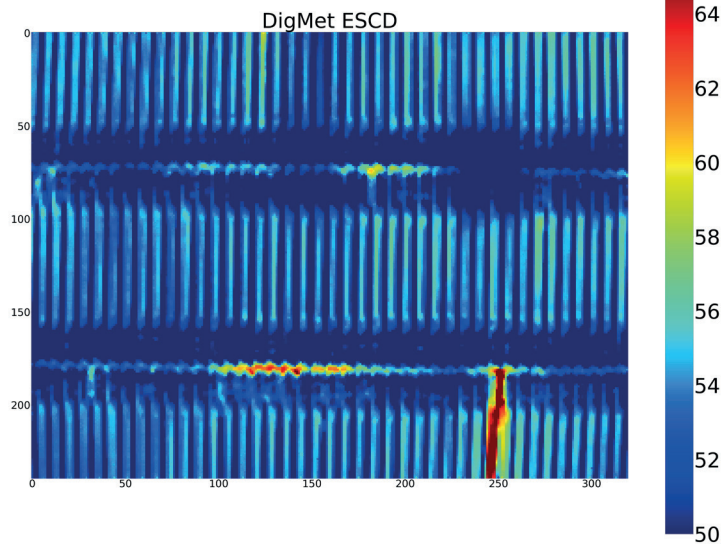
## BENEFIT

- Improved cathode quality
- Maximised current efficiency and productivity
- Lower tankhouse footprint (~ 20%)
- Less cells (~25%)
- Less cathode plates (~25%)
- Less electrolyte and edge strips
- Reduced both CAPEX and OPEX





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## EXAMPLE: Early Short Circuit Detection (ESCD)

Short circuits in electrolysis are caused by the merging of anodes and cathodes. Currently, they are usually detected by analysing the voltage curve and by manual and personnel-intensive searches using gaussmeters. Early short circuit detection allows short circuits to be detected up to 12 hours in advance upon using specially developed thermal camera.



# DIGMET

## ADVANTAGE THROUGH KNOW-HOW AND INNOVATION

The concept of Industry 4.0 or smart manufacturing is attempting to integrate the automatization pyramid vertically. In practice the metal industry is characterized by the fact, that process control and administration of the plant management are only inadequately implemented. Although machine data and process data are collected, they are not widely used for further process automation and optimisation. The metallurgical process control is predominantly dependent on the experience of the employees.

Data acquisition, data aggregation, data visualization, alarms and notifications, integration of enterprise systems, forms, dashboards and data analysis require a platform or intelligent industrial assistance systems with direct access to all production sites. With the help of these assistance systems a controllable process complexity can be managed without compromising process performance and robustness.

Due to the complexity of the metallurgical processes themselves and the variability of the input materials, it is urgently necessary to support the process with modern software solutions for process automation. Our approach is to deal with the possibility of digitising and optimising the process route, analysing this data and simulating it using a combination of machine learning approaches and conventional process simulation. We are closing this gap with our concept called DigMet 1.0, a tailor-made software for process control, automation and optimisation for the whole process route.

## CHALLENGE

### without ESCD

- Low current efficiency
- No short circuit tracking
- High reworking costs

## SOLUTION

### ESCD

- Tailor-made software for process control
- Automatic short-circuit detection

## BENEFIT

### of ESCD

- Increased current efficiency
- Lower reworking costs
- Short circuit detection despite cell cover





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# ILTEC TECHNOLOGY

BEST AVAILABLE TECHNOLOGY FOR SAFE AND EFFECTIVE COOLING

With the new and patented cooling technology ILTEC it is possible to realise a water-free cooling solution. The new state-of-the-art cooling medium IL-B2001 creates a safe operation mode for all application fields and is easy substitute for water. This special ionic salt IL-B2001, with superior characteristics in relation to operational temperature (up to 250 °C), physical properties and especially the lack of reaction when coming in contact with liquid metal or slag, opens up a totally new option in the cooling process in metallurgical plants. But not only the properties of IL-B2001 make ILTEC unique, the combination with special cooler designs for high intensity cooling also enables new application fields. In addition, the higher operation temperature allows heat recovery. The compact design, together with a low maintenance operation mode, an excellent reliability and safety in terms of cooling are only some of the features of the ILTEC Technology. Assembly, installation and start-up on site are conducted within a few days.

## CHALLENGE

- Cooling of highly stressed and critical areas
- Danger of water as cooling medium
- Avoidance of risks and prevention of accidents

## SOLUTION

- Novel and optimised cooling medium IL-B2001
- Closed loop system for easy and reliable leakage detection
- Fully automated operation modes for different applications
- Compact and modular design
- Test rigs for testing of new cooling applications available

## BENEFIT

- Safer operation mode at same heat removal
- New cooling possibilities
- Highest process efficiency
- Minimum downtime and maintenance
- Low operational costs due to increased furnace availability
- Less risk and less impact in case of accident
- Safe cooling of metallurgical vessels
- Possibility of heat recovery







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# COOLING MEDIUM IL-B2001

RESULT OF INTENSIVE RESEARCH FOR A NEW COOLING MEDIUM IN METALLURGY

Basically, ionic liquids are salts, meaning that they consist solely of anions and cations. By definition, ionic liquids have a melting point below 100 °C. For the special application of cooling, the ionic liquid IL-B2001 was designed as a cooling medium to ideally meet the requirements within this application field. What makes it unique is the patented production procedure, making the product free of chlorine.

Property	Symbol	Value	Unit
Operation temperature		Up to 200	°C
Short term stability		250	°C
Decomposition temperature		450	°C
Minimum operation temperature		-10	°C
Crystallization temperature		-30 - -40	°C
Specific heat capacity	$c_p$	1.67-1.99	kJ/kg K
Density	$\rho$	1.25 - 1.14	kg/dm <sup>3</sup>
Dynamic viscosity	$\eta$	20 - 5	mPa·s
Electrical conductivity	K	30 - 130	mS/cm

## CHALLENGE

- Totally avoid the risk of explosions
- Sufficient heat capacity of cooling medium required
- Wide temperature range for operation
- Availability of harmless and noncorrosive cooling medium

## SOLUTION

- Corrosion free
- Nonhazardous
- Explosion free

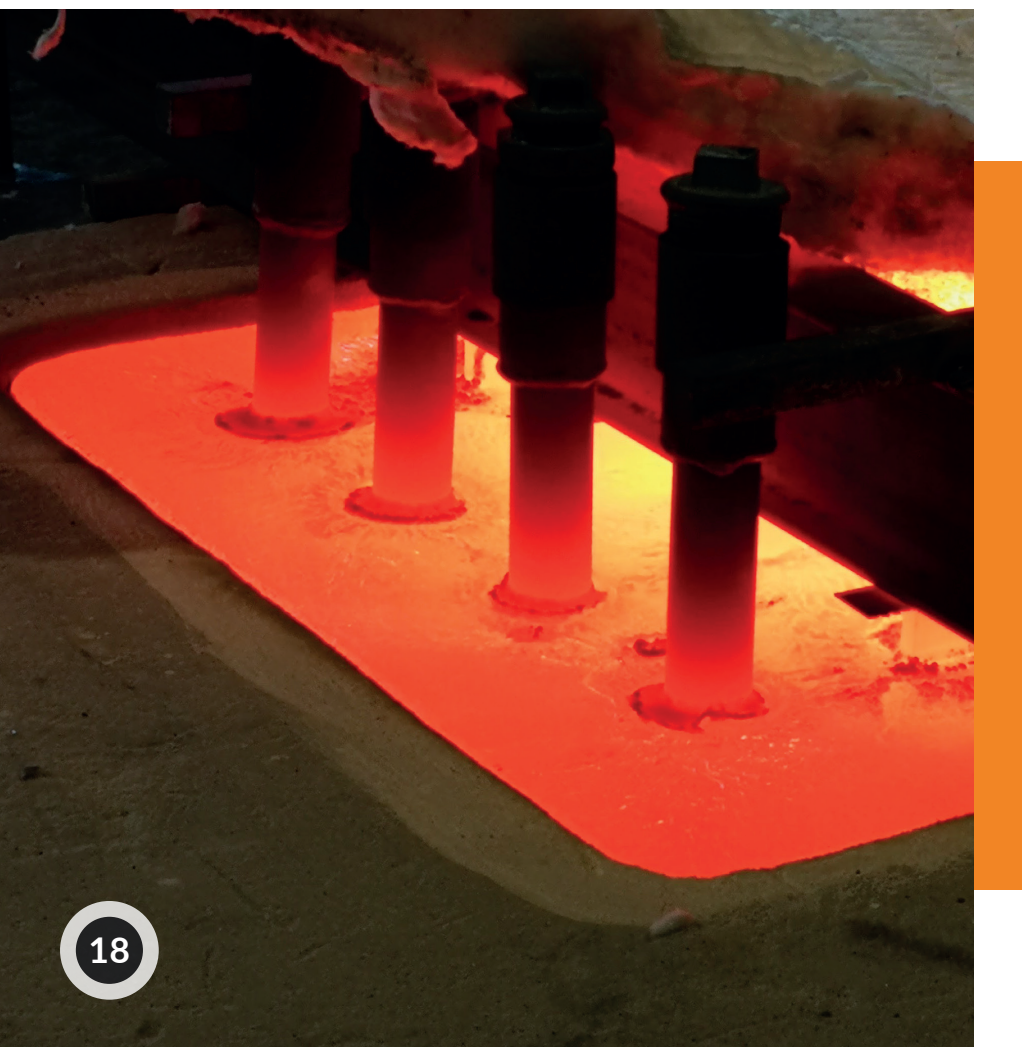
## BENEFIT

- Safer operation mode
- Energy saving by heat recovery
- Higher furnace availability
- The ionic liquid is NOT a consumable material
- Fast leak detection
- Reduced risk of refractory hydration
- Safe work environment





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# HIGH INTENSITY COOLING SOLUTIONS

## CFM - COMPOSITE FURNACE MODULE COOLING ELEMENTS

Mettop's approach of high intensity cooling is the composite furnace module (CFM) Technology.

The design can be described as a compound of a copper cooling element and refractory material. The cast copper coolers consist of a copper back plate with copper fingers at the surface. Within the copper plate, the cooling pipes (made of either copper or nickel alloy) are cast for an optimised flow of the cooling medium. The cooling medium is either water or ionic liquid (ILTEC Technology), depending on the application and the executed risk analysis.

CFM elements show an improved heat transfer through the cooling element. An effect can be the formation of an accretion layer. This so-called freeze lining acts as a protection for the refractory surface and increases the lifetime of the cooled area.

The height and shape of the copper fingers as well as the thickness of the refractory layer is adjusted for each case, e.g. based on the heat transfer and CFD calculations. Therefore, each CFM cooling element is tailor-made and optimised for each specific application.

Compared to other cooling designs, the distance between cooling circuits and hot surface is the greatest. Therefore, the CFM design is the safest way of cooling.

## CHALLENGE

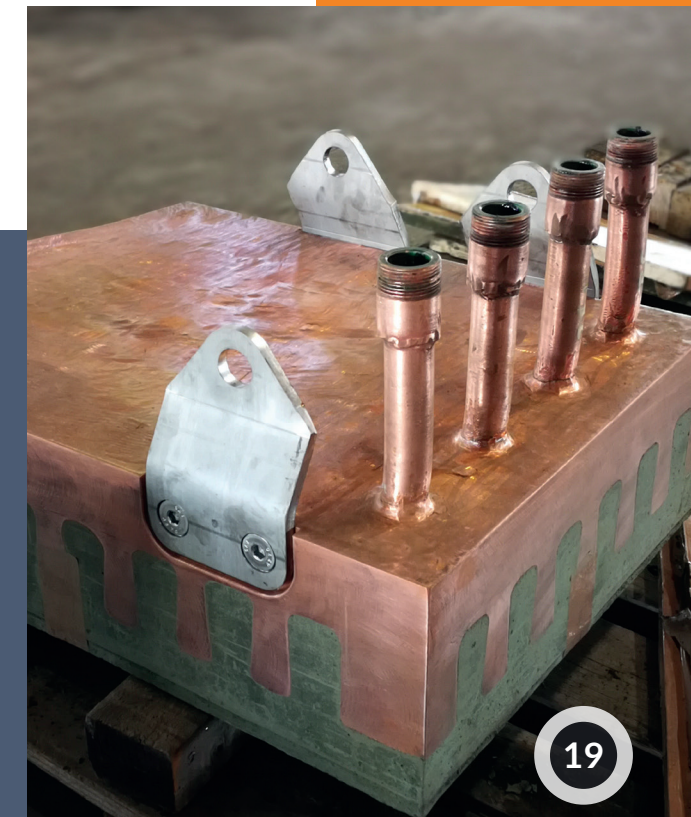
- Reduced vessel lifetime due to high wear areas
- Hot spots
- Interface area between refractory and cooler
- Aggressive liquid phases causing refractory corrosion
- High costs for partial refractory repair
- Furnace downtime

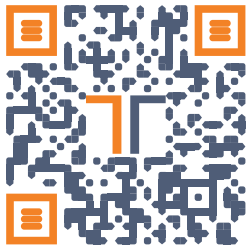
## SOLUTION

- Elimination of high wear areas by active cooling
- Reduce corrosive, abrasive, and nonmechanical wear
- Decreased infiltration due to increased temperature gradient
- Individually designed and dimensioned coolers

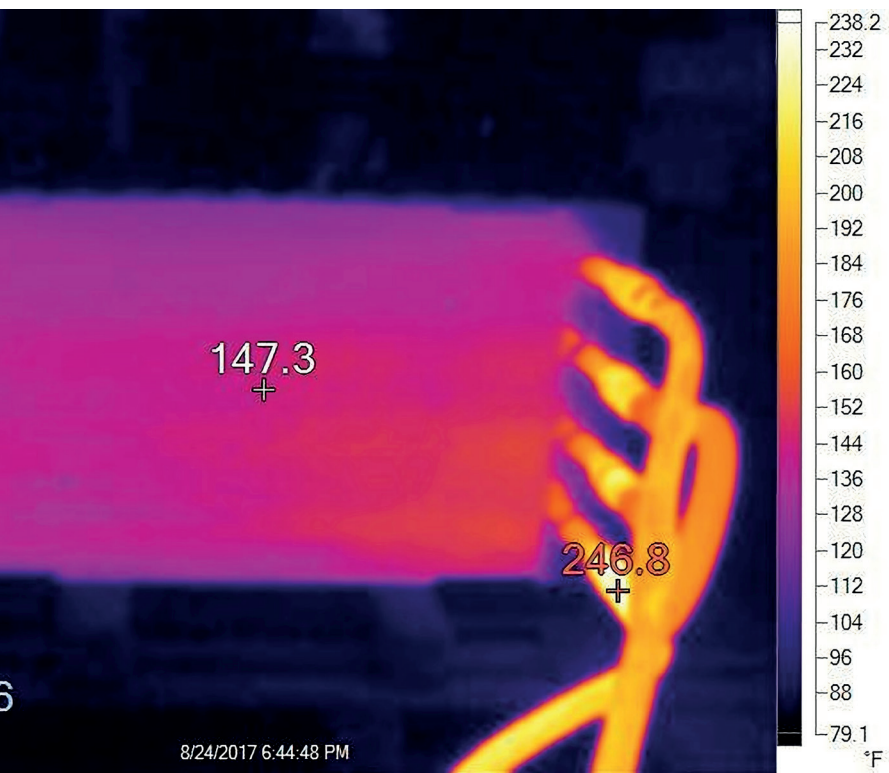
## BENEFIT

- Increased furnace lifetime
- Minimised down time
- Uniform wear of lining
- Recyclability due to copper-in-copper design
- One-stop-shop for furnace integrity





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WeCo





# IONICLIFE CAST TECHNOLOGY

## CAST-IN COPPER PIPE COOLERS

Mettop and WeCo have developed an innovative casting process that enables the casting of copper cooling elements with embedded copper tube. The copper tube is actively and safely cooled by a non-explosive ionic liquid during the casting process. The result is an excellent metallurgical connection between copper tube and copper casting, which leads to a long service life on the one hand and to better recyclability of the copper cooler on the other hand.

In order to achieve a high cooling capacity and a long service life of these coolers, copper tubes are the most suitable for the cooling circuits. This brings with it the challenge of placing a thin metal structure in an environment with a large amount of liquid metal, with a temperature higher than the melting point of the tube. The newly developed "ionicLife cast" method allows sufficient cooling of a copper cooling circuit during the casting process to prevent melting or deformation of the cooling tube. Since cooling with gases is not sufficient and the use of water in the presence of liquid metals is extremely dangerous, cooling with an ionic liquid is the only safe option.

**ionicLife**  
**cast**

## CHALLENGE

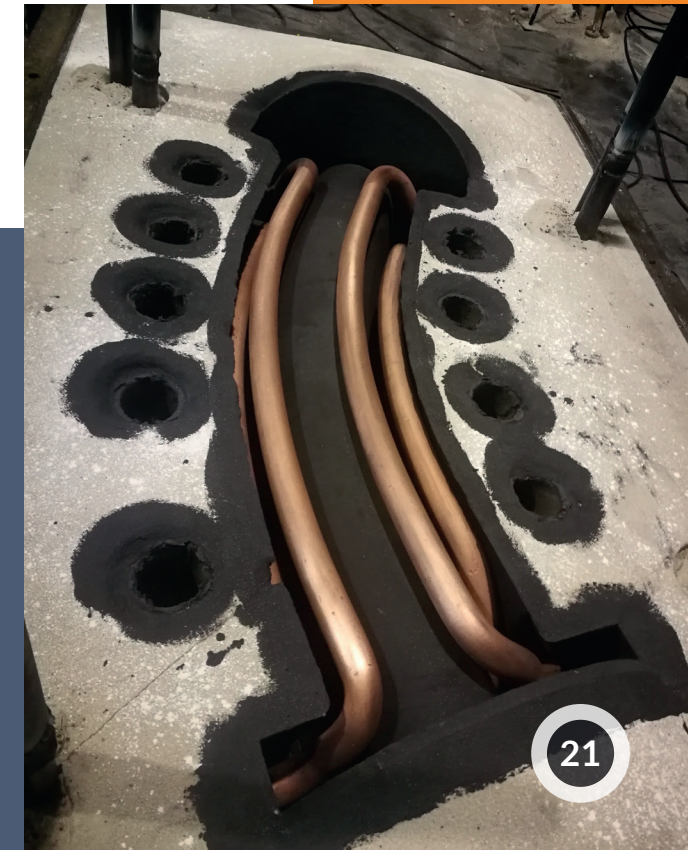
- Casting of cast-in copper pipe only possible for small pieces
- For larger pieces, monel pipes are used due to higher melting point
- Cooling with water during casting is not possible due to explosion risk
- Bending of Monel pipes not possible
- Welds are potential risk for cracks

## SOLUTION

- Cooling of cast-in copper pipe with ionic liquid during casting
- Bending of copper pipe possible, no welding
- High purity copper cast with 100% IACS

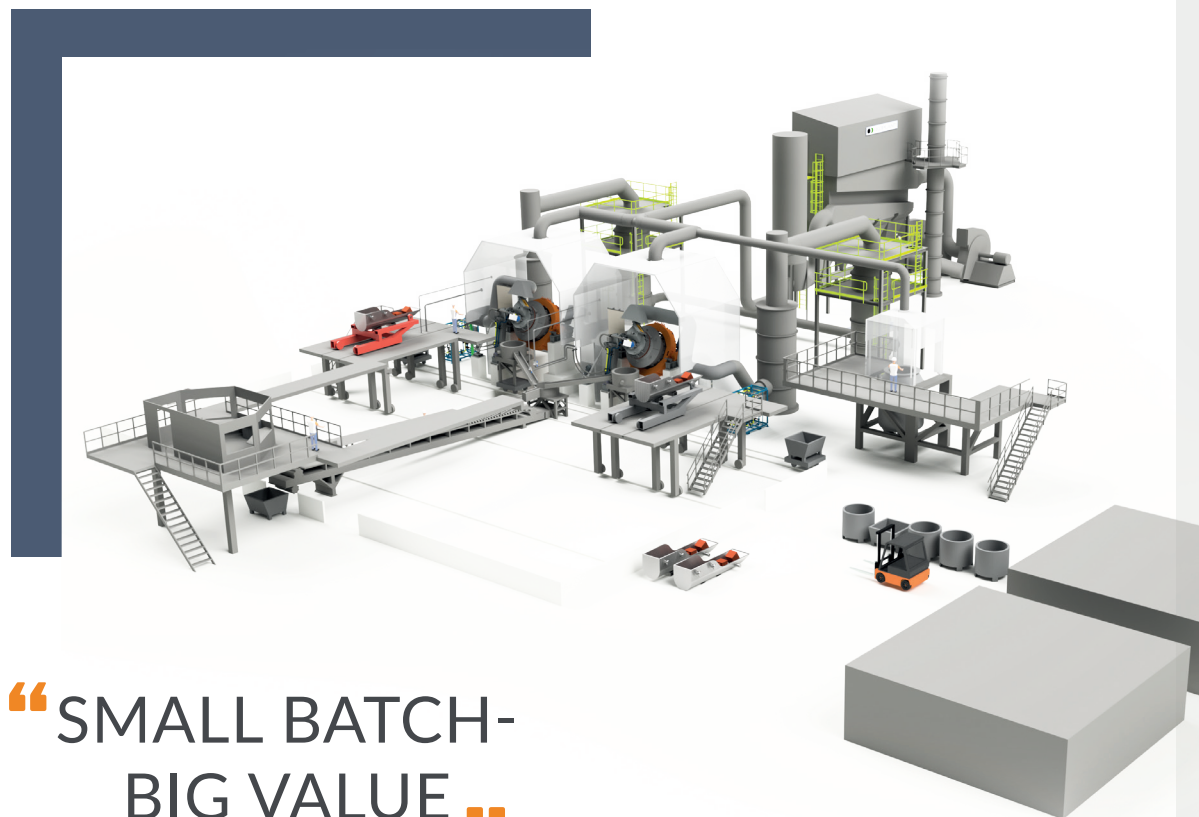
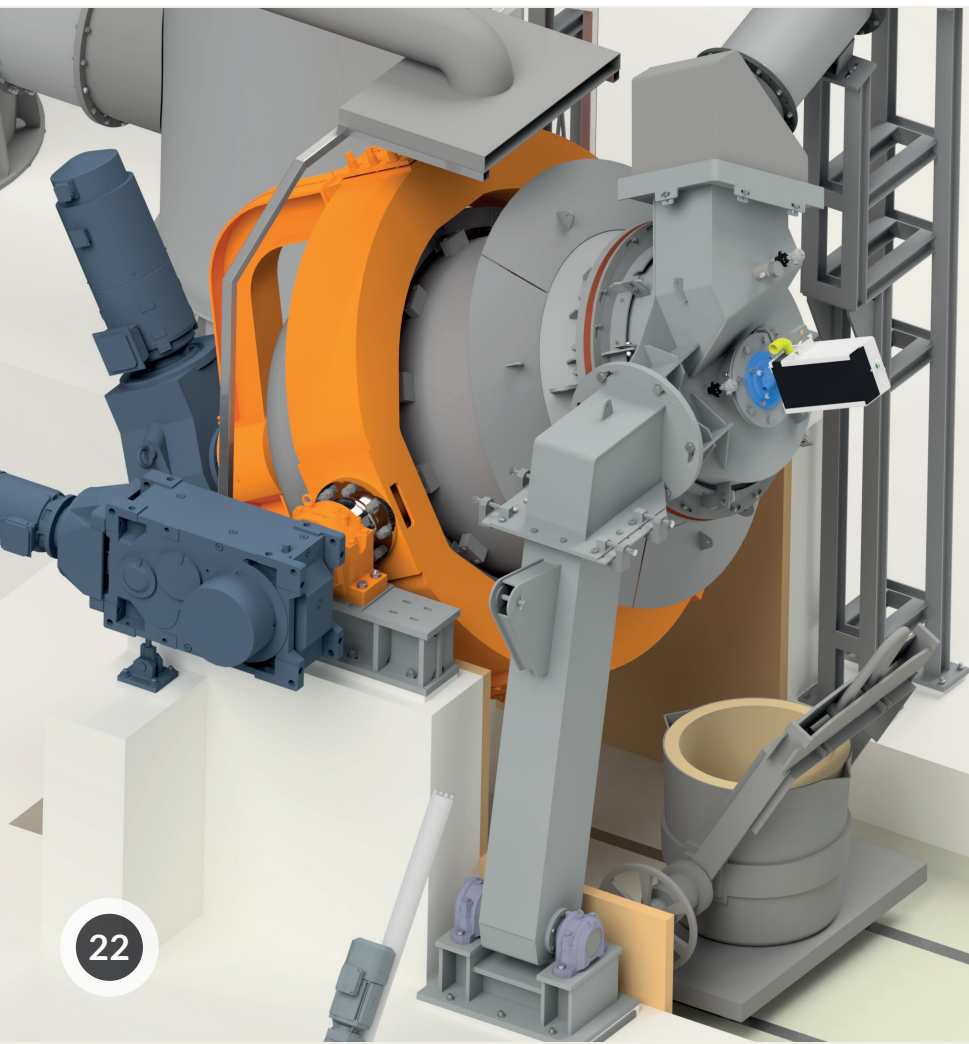
## BENEFIT

- Perfect bonding between copper pipe and copper cast
- Highest IACS conductivity on the market
- Increased lifetime
- Lower cost due to copper pipes instead of expensive monel pipe
- Recyclability due to copper-in-copper design





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“SMALL BATCH-  
BIG VALUE”



# TOP BLOWN ROTARY CONVERTERS

## THE NEXT GENERATION

A top blown rotary converter (TBRC) is a state-of-the-art metallurgical vessel with a wide range of application and operation modes. TBRCs are rotatable and tiltable furnaces, which are usually operated in batches. Charging and casting are commonly carried out via the furnace mouth. It can be used for smelting, pyrometallurgical refining, slag reduction, homogenisation, holding, as a buffer (...) and operated under reducing and oxidizing conditions. The bandwidth of application encloses the nonferrous metals industry, e.g. for copper, nickel, lead, and precious metals.

Mettop's TBRC is a customizable furnace tailored to specific demands and requirements. Possible features are:

- Electro-mechanical drives: Easy Installation and maximum flexibility (Plug & play philosophy)
- No hydraulic system required
- Innovative oxygen/gas-combustion system to produce an intense, stable and compact flame with very efficient heat transfer capabilities and low exhaust volume flow
- Side tapping option
- Multiple lance system (burner, injection, sampling)
- Combinable with different off-gas treatment systems (post combustion, filter, scrubber...)

## CHALLENGE

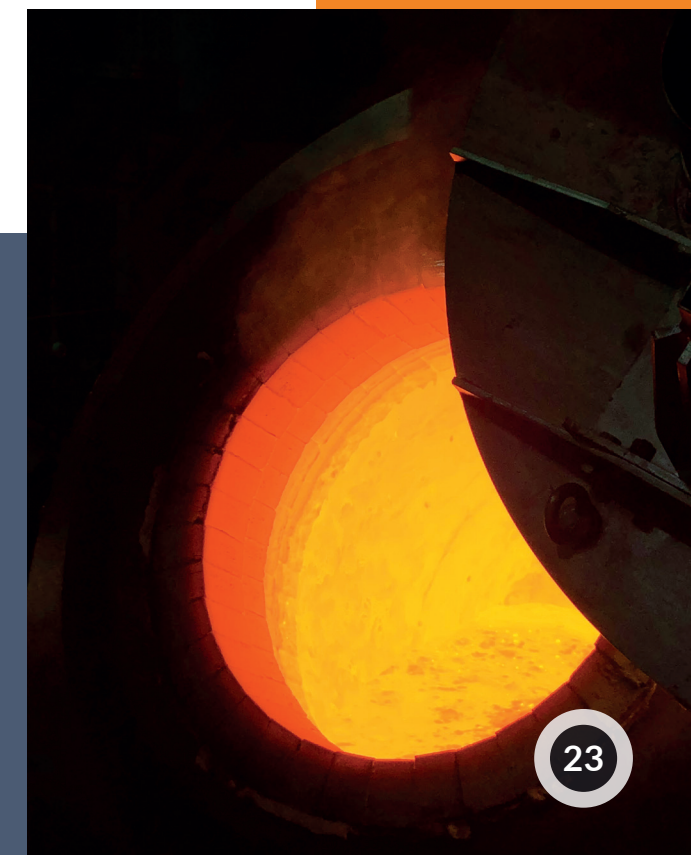
- Change and/or widening the raw material portfolio
- Debottlenecking of production lines
- Combining different process steps in one vessel
- Limited space
- Improving process efficiency

## SOLUTION

- Compact PBRC for small footprint
- Better process efficiency by multiple lance system
- High rotating speed of up to 20 rpm
- Intelligent refractory lining design

## BENEFIT

- Maximised process efficiency
- Improved heat transfer and reaction kinetics in refining and smelting processes
- Lambda values can be adjusted over a wide range to produce reducing, neutral or oxidizing conditions
- High metal recovery and flexible process performance with good slag-metal separation
- Most modern calculation tools for process design including off-gas concept

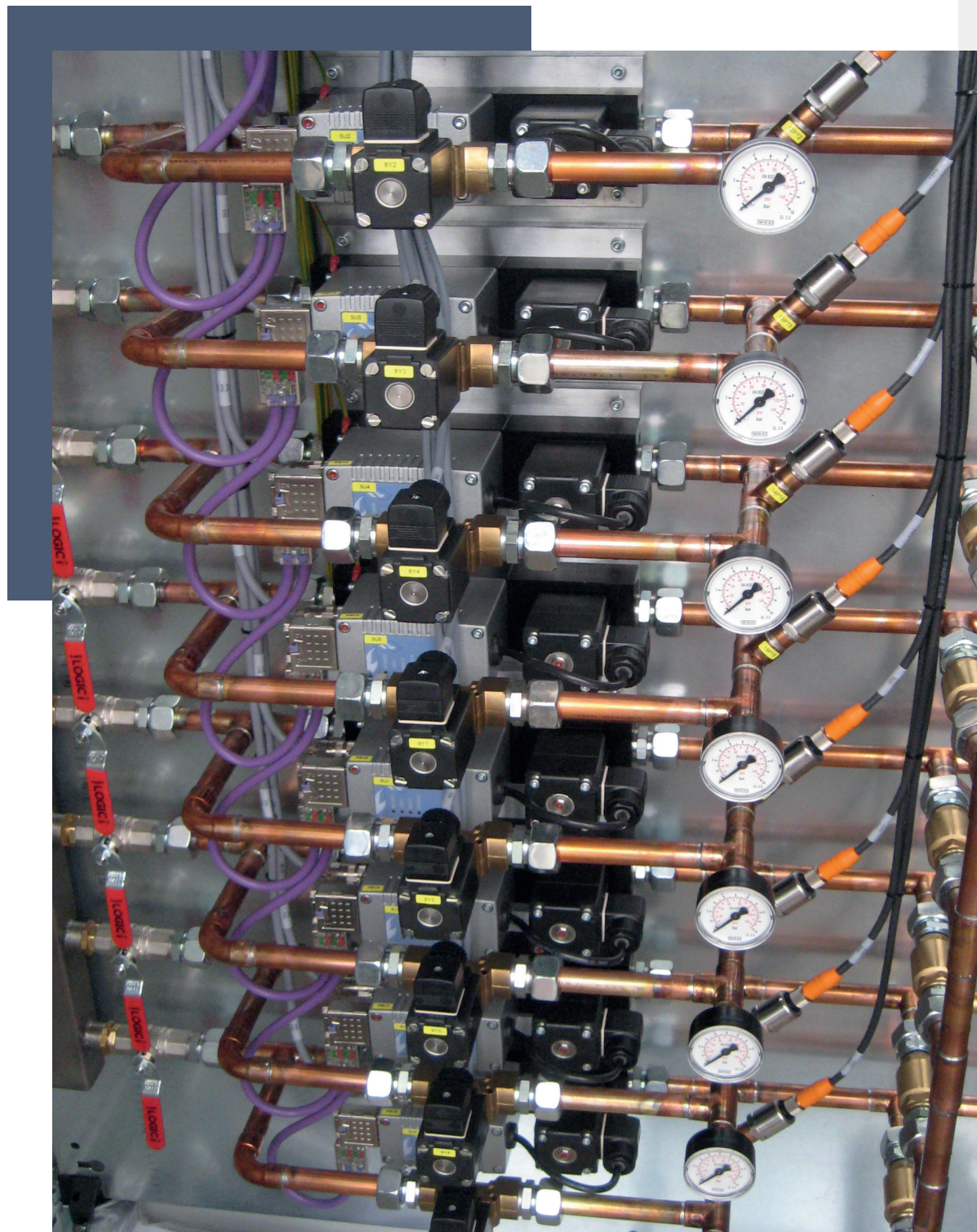
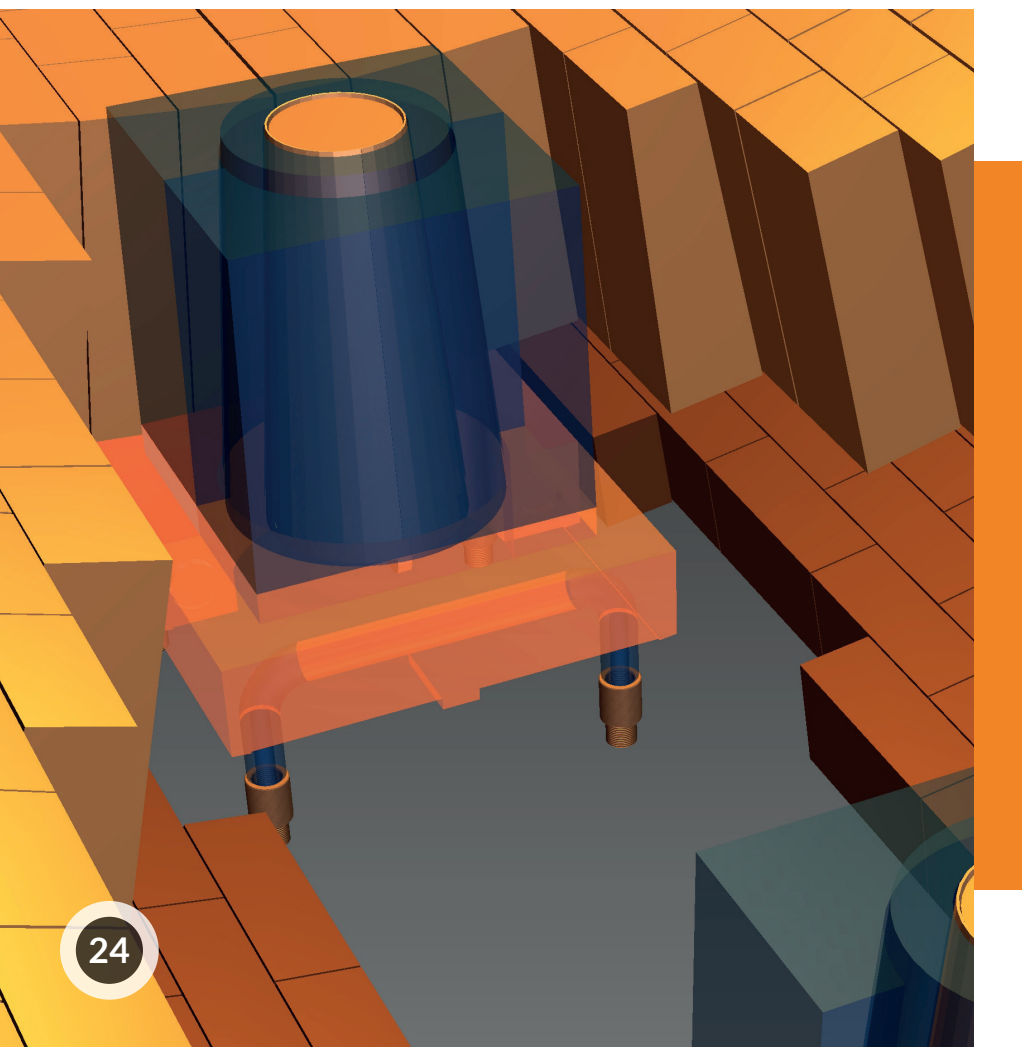






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# N<sub>2</sub>/H<sub>2</sub>-GAS PURGING SYSTEMS

INCREASING PROCESS EFFICIENCY - COST AND TIME SAVING OPERATION MODE

Gas purging refers to introduction of different gases through purging plugs installed at the bottom of a metallurgical furnace. Typical purging gases are nitrogen and argon, but the use of hydrogen is becoming more important.

In principle, purging plugs can be installed in almost every metallurgical furnace for increased efficiency and/or reducing operating costs and process time.

The following advantages can be obtained:

- Gas purging in the anode furnace results in up to 30% less oxidation time, up to 50% less time for deslagging, less reductant consumption, less refractory wear, time savings, and finally cost savings.
- Gas purging can also be applied in the converter to achieve lower sulphur content, lower oxygen content, decreased process time, and decreased deslagging time.
- The use of hydrogen through the purging plugs as a reductant shows superior efficiency compared to natural gas through lances – it reacts directly and the smaller bubble size results in a larger reaction surface.

Mettop's philosophy is not only to install the purging system, but also to train the on-site personnel to obtain the maximum out of gas purging systems.

## CHALLENGE

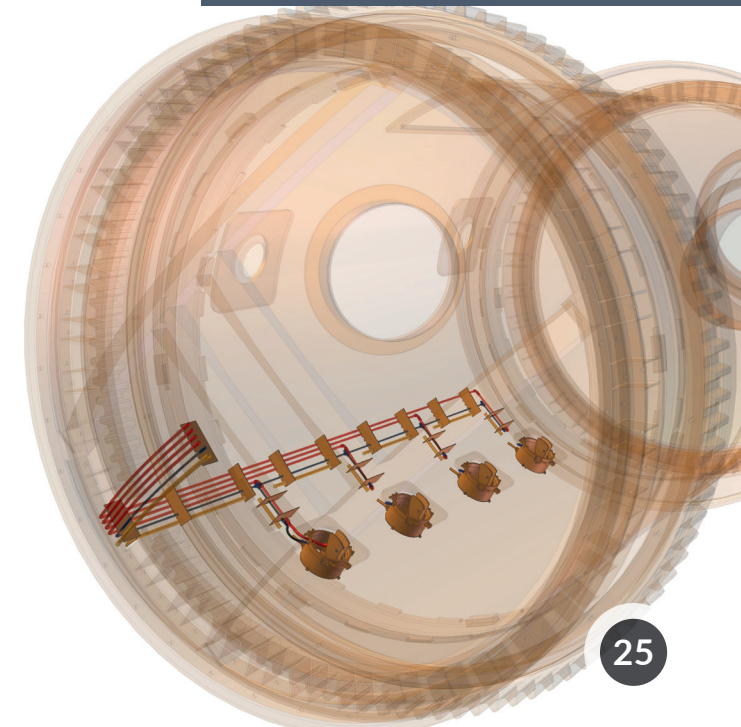
- Minimising operation costs
- Bottlenecks in the production line
- Inefficient metallurgical reactions
- Utilisation of maximum furnace volume by avoiding built ups

## SOLUTION

- Installation of Mettop's gas purging package
- Gas control units for purging N<sub>2</sub>, Ar and H<sub>2</sub> (and all mixtures)
- Optimised positioning for obtaining the most benefits
- Training of operators to gain maximum benefits

## BENEFIT

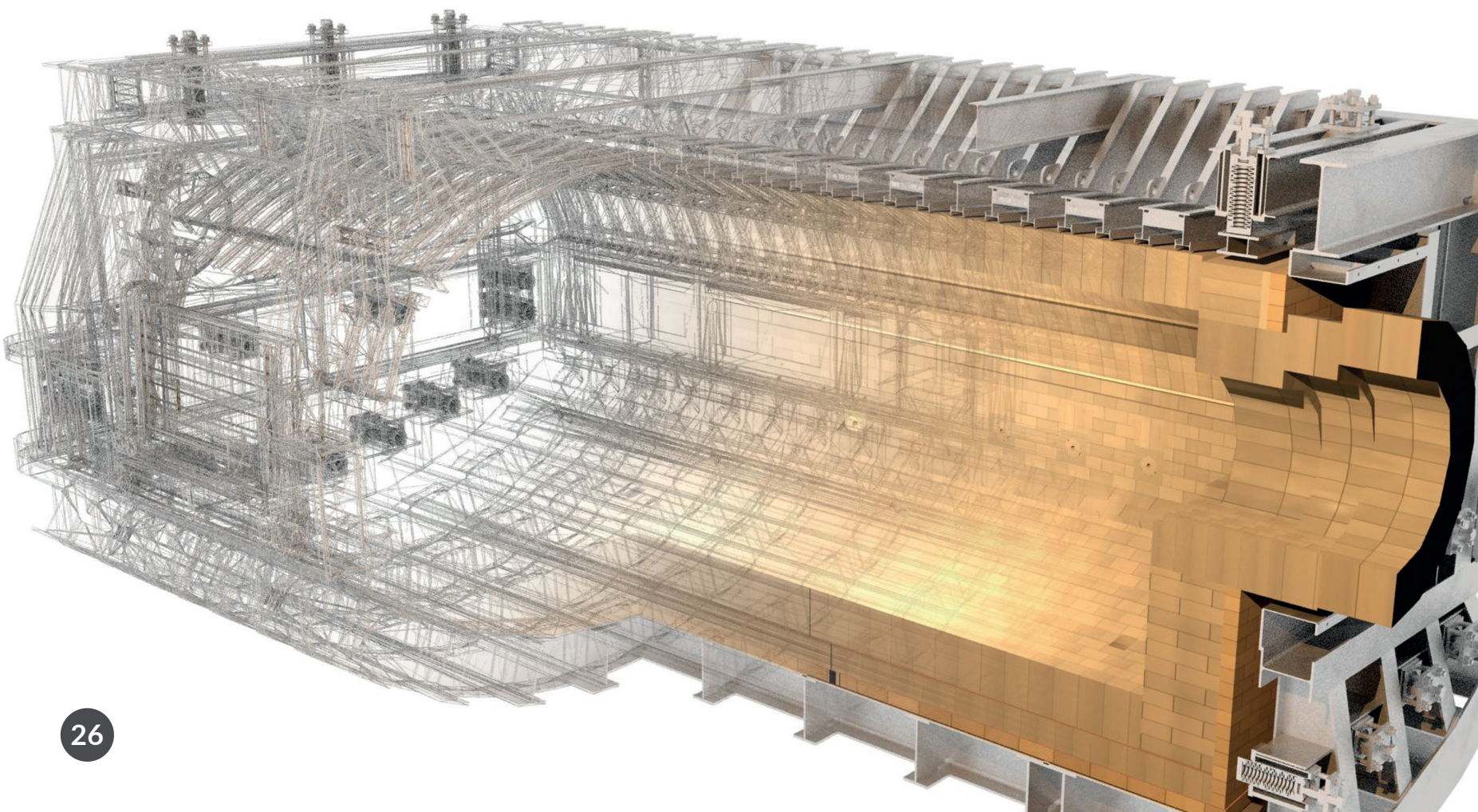
- Maximum homogenisation of the melt
- Better kinetics due to increased bath movement and turbulence
- Superior reaction, increased oxidation, and reduction efficiency
- Easier and more complete deslagging
- Decrease of accretions
- Extended refractory lifetime





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# REFRACTORY MANAGEMENT

## THE KEY TO MINIMISING OPERATING COSTS

In addition to an optimised process, the refractory performance is the key factor for low operating costs in nearly all metallurgical vessels.

To define the correct quality based on the wear mechanism is only the start of the process. A proper refractory engineering plan, in terms of shapes, installation procedure, thermal expansion calculation and so on, is as important as a perfect installation itself. However, refractory management means much more. An equal wear of the entire lining material at the end of the furnace lifetime is one of the goals. The implementation of cooling elements in high wear areas is part of the engineering and also part of a furnace integrity approach.

To create a perfect synergy of refractory design, cooling element arrangement, and process operation we use the most modern 3D construction methods, CFD calculation, and process modelling tools.

However, refractory management also means refractory stock management, shape optimisation during engineering, optimised ordering process, ongoing test works to minimise refractory costs and simultaneously increase furnace availability.

## CHALLENGE

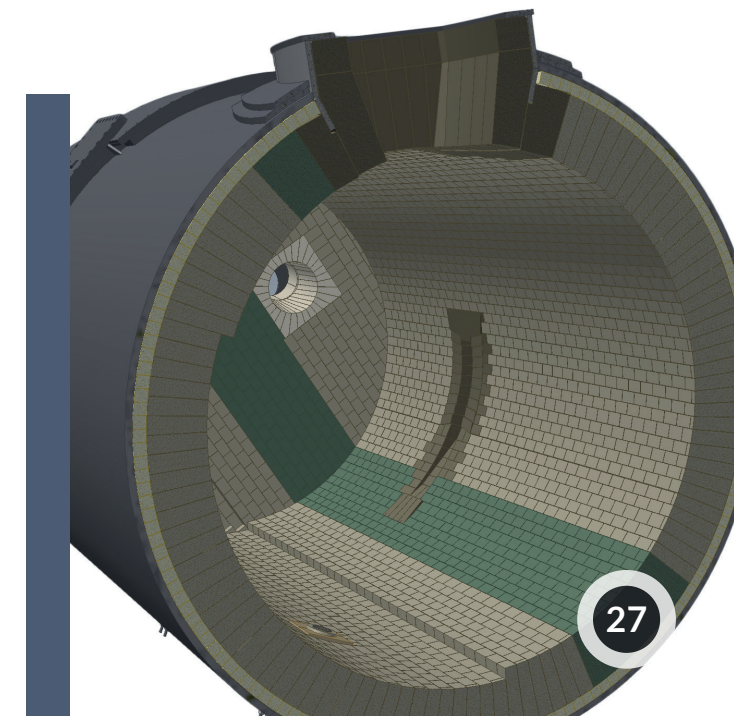
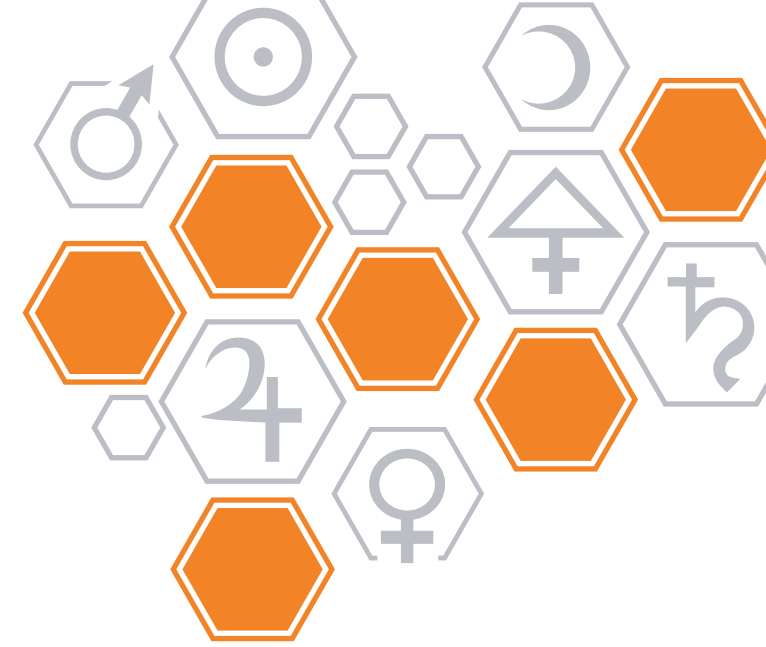
- Increased cost sensitivity
- Minimising refractory costs at an optimised quality level
- Higher requirements of the metallurgical process
- Demand to reduce and synchronize vessel down time
- Environmental aspects

## SOLUTION

- 3D brick by brick model
- Step by step installation video
- Detailed downtime and shutdown planning
- Technical assistance during installation and start-up support
- High quality refractory materials
- Combined refractory and process know-how
- Detailed bill of materials
- Independent refractory engineering

## BENEFIT

- Optimised refractory effort
- Minimised downtime for relining
- Independent and objective refractory concepts
- Supplier independent brick lists











# METTOP ACADEMY

## TRAINING COURSES AND SEMINARS

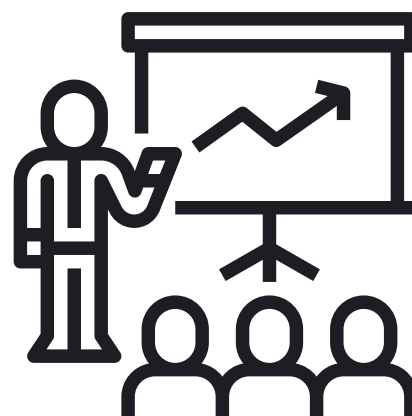
Mettop offers a wide range of practically orientated training courses and seminars on various topics related to nonferrous metallurgy, combining experience and knowledge, with rigorous data research.

These courses and seminars are held in different stages. Mettop's trainers are highly experienced in the field of nonferrous metallurgy, not only on a theoretical, but especially on a practical level, resulting from worldwide industrial practice and experience.

Trained personnel are beneficial for both, new and existing systems. In new installations, full availability is provided short term, while in already operating systems, competent, trained staff ensure and maintain high availability and productivity.

The basic courses consolidate a general understanding of metal production routes, whereas the more specialised courses focus on more detailed information about certain production processes.

In addition to the general and special courses, customer-tailored seminars and training programs are available – they are designed according to specific customer requirements.



## SPECIAL SEMINARS

### RIGOROUS AND IN-DEPTH KNOWLEDGE

Special courses focus on unique areas and fields of interest within the entire field of nonferrous metal production, as desired by the customer. The course comprises of process optimisation, furnace integrity, cooling solutions, refractory design, and economical studies.

## CUSTOMER TAILORED COURSES

### TAILOR-MADE TOPICS FOR YOUR NEEDS

For any desired topic regarding metallurgy, Mettop can offer customer-specific courses.

As an example, the seminar content of the course titled "Copper electro-refinery" comprises:

- Basics of copper electro-refining and detailed electro-chemical reactions
- Geometry influence on the current density distribution
- Influence of inhibitor dosage and microscopic ground section analysis
- Current density distribution optimisation and maximising copper cathode quality
- Shortcut detection
- Newest analytics and technologies



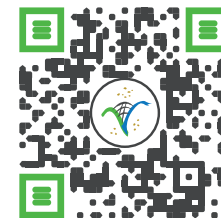


UrbanGold  
recycling for a green future



# INTRODUCTION URBANGOLD

## RECYCLING FOR A GREEN FUTURE



UrbanGold is responsible for recycling, process design, and process modelling. UrbanGold's vision is to set a new standard in metallurgical recycling technologies in the field of electronic scrap, as well as complex valuable and precious metals containing materials.



Recycling of almost all valuable secondary raw materials requires the enrichment of metals, as well as the separation of unwanted accompanying substances. In the case of e-waste, there is also the aspect of a high content of organics. These substances overheat conventional vessels; furthermore, an advanced and effective off-

gas system is required due to the halogen content. As a result, the amount of e-waste in the raw material portfolio of conventional technologies is limited. UrbanGold technologies provide a solution for proper metallurgical treatment of all nonferrous qualities of e-waste – including the lowest ones. The UrbanGold technologies

combine the advantages of both pyrometallurgical and hydrometallurgical processes while reducing the disadvantages of each. Recently, flexible recycling concepts for almost all kinds of e-wastes have been developed – ensuring a high yield for all relevant valuables. In combination with UrbanGold's HENRI smelter, this represents a new state-of-the-art for e-waste processing.

### URBANGOLD'S SERVICES:

- Project development – we are your partner for the development of metallurgical recycling facilities
- Consulting on treatment of secondary raw materials containing nonferrous metals
- Case studies, feasibility studies, and business plan development
- Development of recycling concepts as a comprehensive solution including raw materials, product portfolio, environmental technology, material handling and logistics, as well as economic feasibility
- Design of process models as a basis for detailed mass and energy balances
- UrbanGold Technologies – state-of-the-art recycling solutions for all qualities of e-waste fractions

“CIRCULAR ECONOMY - THE NEXT LEVEL”



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# PROJECT DEVELOP MENT

## Planningphase

Feasibility

Seed funding

Project  
development

Fund raising

Financial closing

### ✓ Consulting services

✓ Market study  
✓ Concept study

✓ Business model

✓ Process- and layout  
engineering  
✓ Facility design  
✓ tendering

✓ Business plan

## Realizationphase

Construction

Cold test

Start-up

Operation

Optimization

### ✓ Consulting services

✓ Project support  
✓ Project monitoring  
✓ Interface  
management  
✓ Facility & licence

✓ Supervision  
✓ Acceptance

✓ Supervision  
✓ Metallurgical start-up  
✓ Acceptance

✓ Metallurgical  
assistance  
✓ Training and  
work shops  
✓ Software packages

✓ Studies



# PROJECT DEVELOPMENT

## COMPETENCE IN RECYCLING & E-WASTE PROCESSING

Planning a metallurgical recycling facility is the top class of project development. Expertise in a variety of complex technical topics is required as well as deep knowhow of the business model of smelting and refining valuable metallic and complex raw materials.

Additionally, the environmental protection and a sustainable operation are of major importance and can influence the business model dramatically.

UrbanGold has the complete knowledge required for proofing feasibility, creating a technical concept, considering legal aspects, and environmental protection, as well as realising the undertaking on behalf of the project owner. Furthermore, we are also your partner for commissioning, start-up, training, and long-term operation including further optimisation to continuously improve economic success.

We are the ideal partner for:

- Planning metallurgical recycling facilities for copper scrap and complex raw materials
- Developing business models within the metallurgical recycling industry
- Realising projects in the complex field of metal production from complex recycling streams
- Technically optimising existing facilities for increasing operational efficiency

## SERVICES

- Consulting on all project phases
- Planning phase: Market, feasibility, and concept studies; elaboration and evaluation of technical solutions; business case development; process and basic engineering; third party evaluation; discussion partner for environmental agencies, landlords, authorities, equipment supplier, civil engineers ...
- Realisation phase: Tendering procedures incl. assessment; project monitoring; interface management; review of project progress; supervision of commissioning, start-up, and acceptance; training and workshops; continuous plant optimisation

## BENEFIT

- Comprehensive expertise from a single partner
- Objective recommendations
- Critical analyses and studies
- Obtaining an in-depth knowledge basis for decision making
- Neutral and independent discussion partner
- Truthful cooperation





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# PROCESS DESIGN





# PROCESS DESIGN

## DESIGNED FOR PROFIT

A core competence is the development and design of metallurgical recycling processes. UrbanGold has specialized in nonferrous metals containing secondary raw materials, as there are fractions from electronics or automotive waste streams, but also alloys and cable scrap. The focus is usually on the metal extraction, as metals typically finance recycling efforts. However, "by-products" such as electrical energy, bromine, salts, construction material (...) have their place in the recycling chain as well.

UrbanGold follows the approach of a stepwise development: Depending on the novelty of a concept, a project can start directly with plant design, but also in the early stage of a literature research and laboratory scale tests.

Based on the raw material – or alternatively the desired products – a recycling chain with all the internal circuits and special features will be developed. Depending on customer requirements, the (mechanical) preparation, auxiliary equipment, environmental technology, energy recovery, but also legal framework conditions are part of the considerations.

The recommendation of suitable metallurgical units and the specific features for the designated process is part of the work. The process design is usually the first step in the engineering phase – which as a product represents a mass and energy balance with an estimate of the necessary consumables.

In addition, trials can be carried out in laboratory, technical and/or pilot plant scale with the raw materials provided to optimise facility design and metallurgical process. The findings are interpreted in the form of a test report and can thus support the decision-making process for project realization.

## CHALLENGE

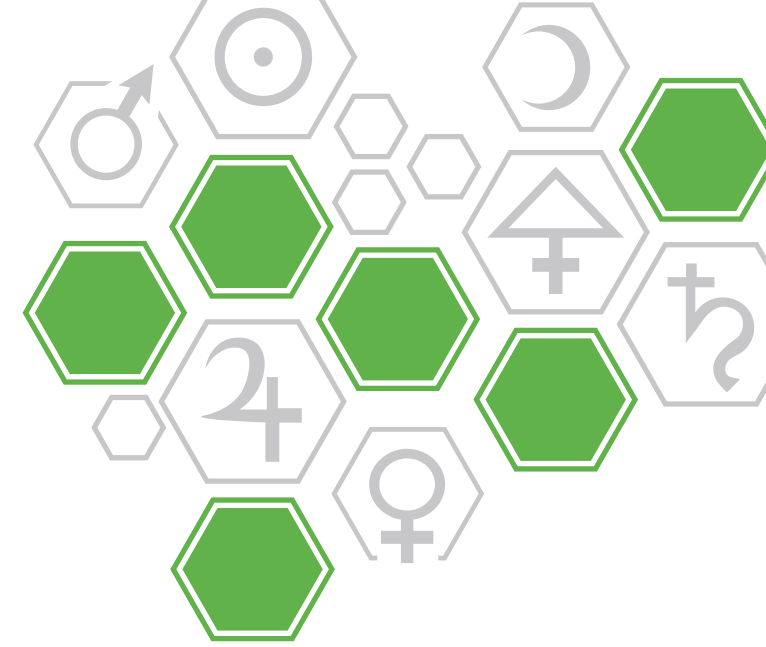
- Lack of suitable standard solutions for secondary raw materials
- Lack of specialized know-how for prospects outside the core business
- Significant influence of legal framework and environmental regulations
- Energy efficiency

## SOLUTION

- Process development for novel recycling solutions
- Process design for established technologies
- Process engineering as part of the overall engineering phase

## BENEFIT

- Customer tailored recycling solution optimised for a specific application
- Estimation of media, energy, and auxiliary consumption
- Prediction of products amount and quality
- Stepwise approach to continuously precise technical and financial data
- In depth data for go/no-go decisions



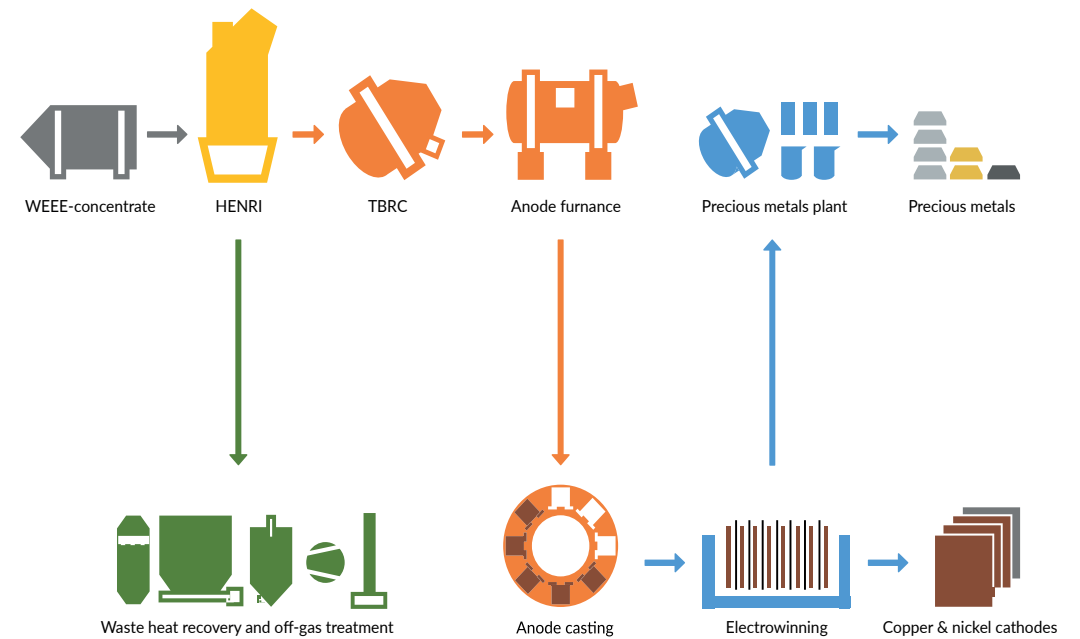


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UG  
TECHNO  
LOGIES

## URBANGOLD FLEX FACILITY



Exemplary plant setup



# URBANGOLD TECHNOLOGIES

## FOR MAXIMUM FLEXIBILITY

Recycling of e-waste requires the enrichment of metals, as well as the separation of unwanted accompanying substances. The high content of organics can overheat metallurgical vessels and the light metals content complicates slag metallurgy. A modern and effective offgas system is required due to the impurities content. As a result, processing of e-waste is the top class of metallurgical recycling.

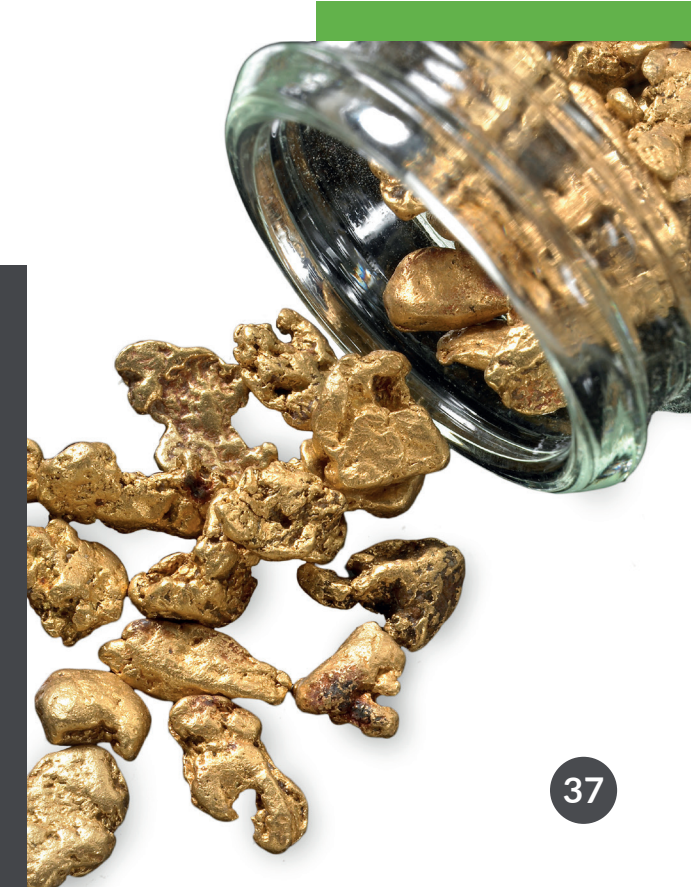
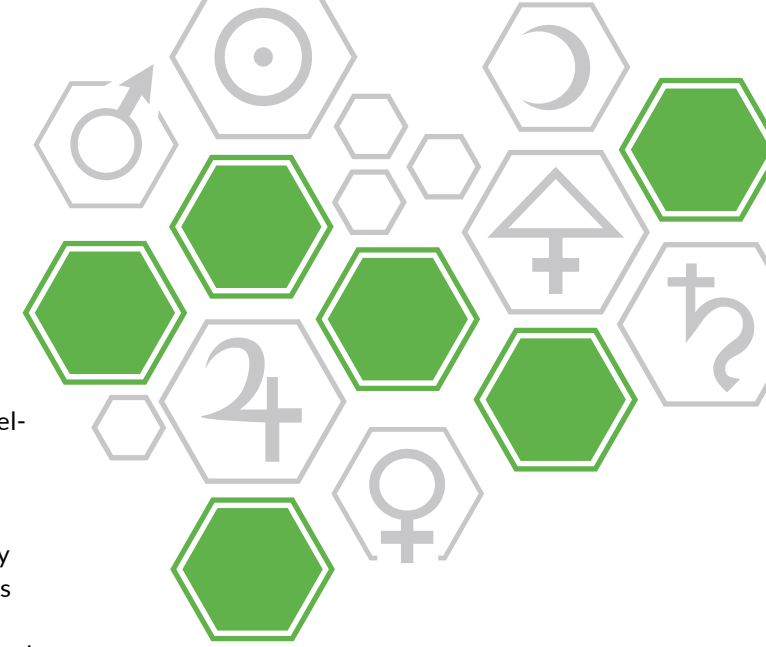
With our processing solutions, we stand out of the crowd and our HENRI smelter represents a new state-of-the-art for e-waste processing. We provide solutions for proper metallurgical treatment of all nonferrous qualities of e-waste – including the lowest grades. Our focus lies on the metallurgical process to combine the advantages of both pyro and hydrometallurgy while reducing the disadvantages of each. Recently, flexible recycling concepts for almost all kinds of e-wastes have been developed – ensuring a high yield for all relevant valuables.

## SERVICES

- Project support: We are your partner, from the initial project idea – via all phases of project development and engineering – from construction, to start-up, operation, and optimisation.
- Market, feasibility, and concept studies: We can carry out all types of studies within the feasibility and development phase to improve your business case as a basis for further project funding.
- Process engineering: We provide detailed mass and energy balances, estimate the results of your facility operation, and prepare the basis for equipment design and infrastructure planning.
- Basic engineering: The basic engineering is the fundamental design of the facility including auxiliary equipment; it usually provides enough information to begin civil engineering and permitting procedures.
- Equipment supply: Either as single contractor or as part of a consortium we supply metallurgical equipment for processing your desired volume and quality of e-waste fractions.
- Knowhow transfer: Especially in cases of existing facilities, our knowledge of e-waste processing can be provided by onsite training and workshops, as well as by software packages to support facility operation.

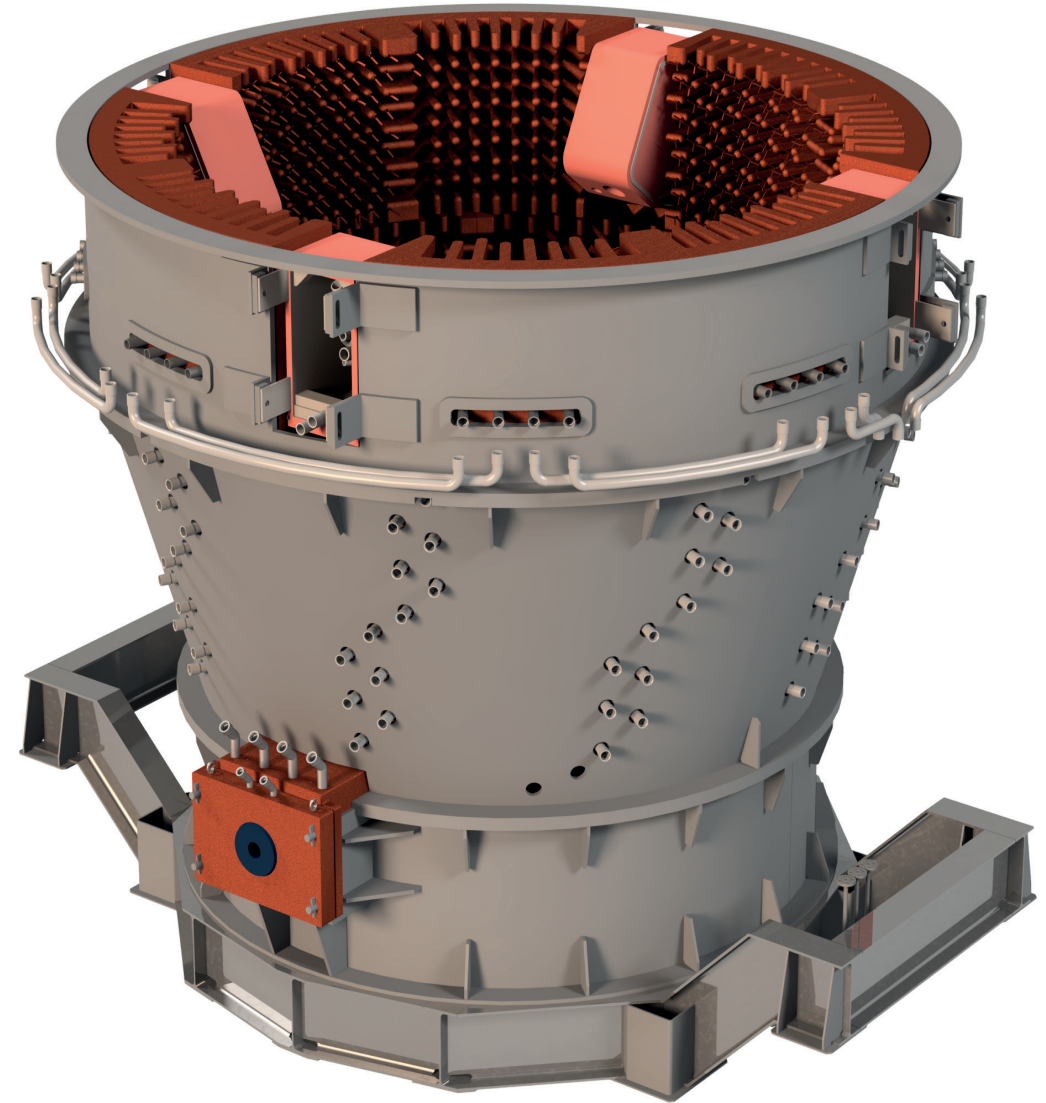
## BENEFIT

- Tailor-made with respect to size, raw materials, and products
- Modular and expandable design
- All-inclusive solution
- Production of easy marketable products





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# URBANGOLD'S HENRI SMELTER

## A NEW STANDARD IN E-WASTE SMELTING

The primary smelting furnace within the pyrometallurgical facilities, the HENRI represents the centrepiece of the UrbanGold Flex recycling technology. The pyrometallurgical treatment carried out in this unit ensures an enrichment of valuable metals in a metallic phase and a separation of organic compounds and metallic impurities. The HENRI is designed to process up to 100 % of e-waste fractions and therefore must meet the following requirements:

- Managing high volumes of organics in the feed material and the correspondingly high energy input
- Managing the input of halogens as part of the organic fractions
- Managing the input of aluminium and aluminium oxide
- Effective reduction with maximum metal yield and slag generation with minimal valuable metal contents
- Maximum flexibility in respect to feed material composition
- High availability and minimum downtime for maintenance

The HENRI is a highly specialized smelting furnace based on the bath smelting technology, which is well-established in the copper, lead, and zinc industry. Depending on the individual requirement of each application, it will be customer-tailored and adapted accordingly. The range starts at a simplified and partly manually operated "HENRI MiniSmelter" for some tonnes per charge and ends at an almost fully automated large-scale unit within an UrbanGold Flex plant for 100,000 tonnes of raw material per year or even more.

## CHALLENGE

- Conventional smelting vessels are not optimised for e-waste recycling
- Especially low-grade fractions cause problems during furnace operation
- Several challenges – such as, heat balance, slag chemistry, furnace atmosphere (...) need to be addressed

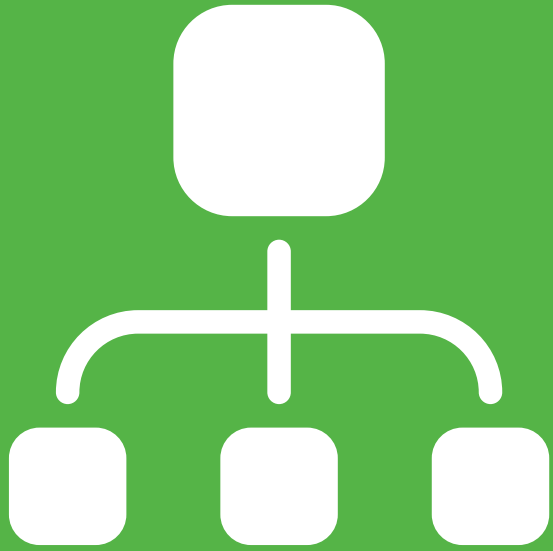
## SOLUTION

- A highly specialised smelting vessel based on the established bath smelting technology
- Highly modular design for numerous applications and raw material mixes

## BENEFIT

- Customer tailored design for each individual application
- Highest flexibility with respect to raw material mix and processing capacity
- Optimised waste heat recovery and most modern off-gas treatment for minimising environmental impact
- Specially designed metallurgical work and maximized extraction efficiency





# PROCESS MODEL LING





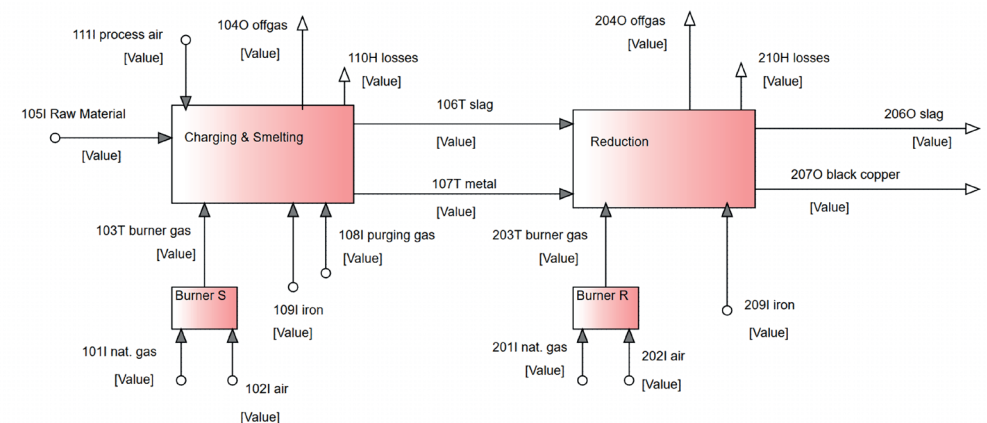
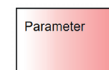


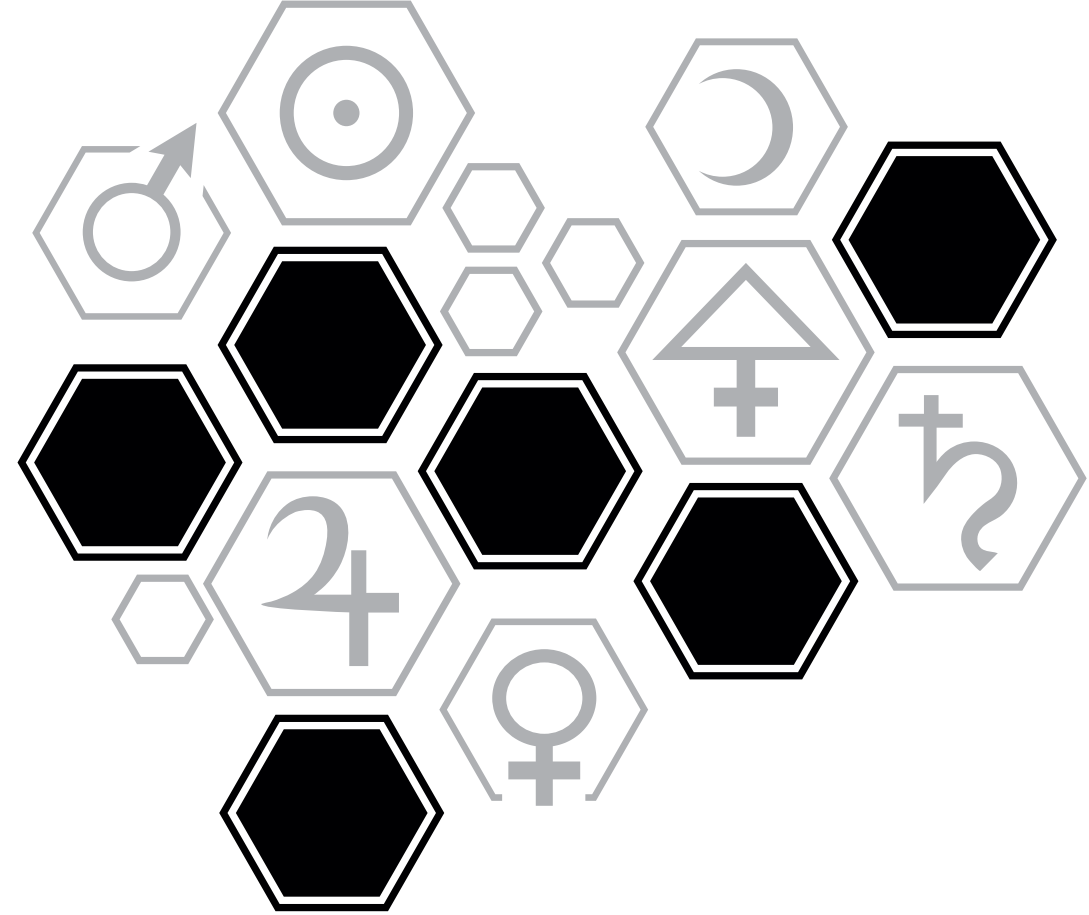
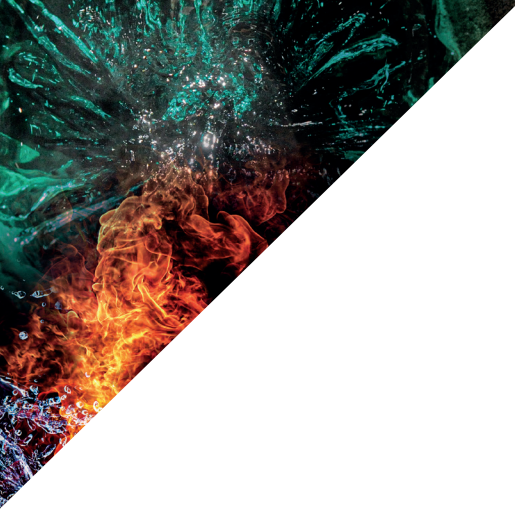
# PROCESS MODELLING

## TAILOR MADE CALCULATIONS FOR IMPROVING FACILITY DESIGN AND BUSINESS CASE

Within the concept and engineering phase of a metallurgical plant, process modelling has been established as a powerful tool for supporting design work. In addition to defining proper capacities for vessels and supply systems, a process model depicts the designated operation with sufficient accuracy to estimate economic figures. Furthermore, internal recycling streams can be considered, bottlenecks visualized, and possible operational challenges can be addressed at an early stage.

UrbanGold's process concepts are a visualization of a designated metallurgical concept with basic unit data, as well as the major mass flows between the individual units. An off-gas treatment is a typical extension – which is especially recommended if a recycling of complex and/or hazardous elements containing raw material is processed. Data from process models can be used both for plant engineering as well as establishing a financial plan and business model. The accuracy of financial models dramatically increases when systematic models are used instead of relying on reference projects only.





Austria - Europe

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