Metso:Outotec

Hydrometallurgical Zinc Plants and Processes

Benefits

- Tailored and optimized technology solutions
- Unique laboratory facilities and expertise
- Process guarantees
- Environmentally friendly
- One-stop shop concept: testing-engineering- process—equipment—automation-services
- Excellent references

Our expertise and experience provide the path to optimized solutions and complete plants for the production of high-quality zinc, from a wide range of zinc raw materials. Metso Outotec offers innovative and proven roasting, leaching, precipitation, solution purification, solvent extraction, Ausmelt TSL smelting, electrowinning and casting technologies as well as concentrator and sulfuric acid plants.

We offer one-of-a-kind technology solutions where the engineering is based on testing to ensure the delivery of proven plants, processes, equipment and automation as well as unbeatable service and support. Customer needs and the unique characteristics of raw materials are at the heart of our process design.

Metso Outotec offers:

- Innovative and proven technologies
- Laboratory test programs and pilot test campaigns
- Scoping and feasibility studies
- Basic and detailed engineering
- Proprietary and key equipment supply
- Process automation and instrumentation
- Turnkey plants
- Training, commissioning and start-up services
- Operation and maintenance services
- Spare parts
- Plant audits, retrofits and equipment upgrades

A committed partner from the start

Metso Outotec operates globally through an extensive network of sales and service centers. Metso Outotec provides its customers with an unrivalled combination of process expertise, equipment and services and focuses on developing its technology solutions and services for the mining, metallurgy and chemical process industries. We continuously strive to build long-term relationships with our customers, ensuring that they receive the very best solutions for their operating environment. Our expertise in zinc technology covers the whole chain of production, from concentrator to zinc casting equipment. Involving Metso Outotec in your projects at an early stage ensures you get the most profitable and competent solutions.

We provide world-leading technologies, technology selection expertise based on laboratory test programs, feasibility studies, basic and detailed engineering, technology-specific equipment supply, training, erection supervision and start-up assistance, as well as follow-up and technical support services. This level of involvement from a single partner offers you the possibility to enhance your production processes and minimize operating costs throughout the lifetime of the plant.

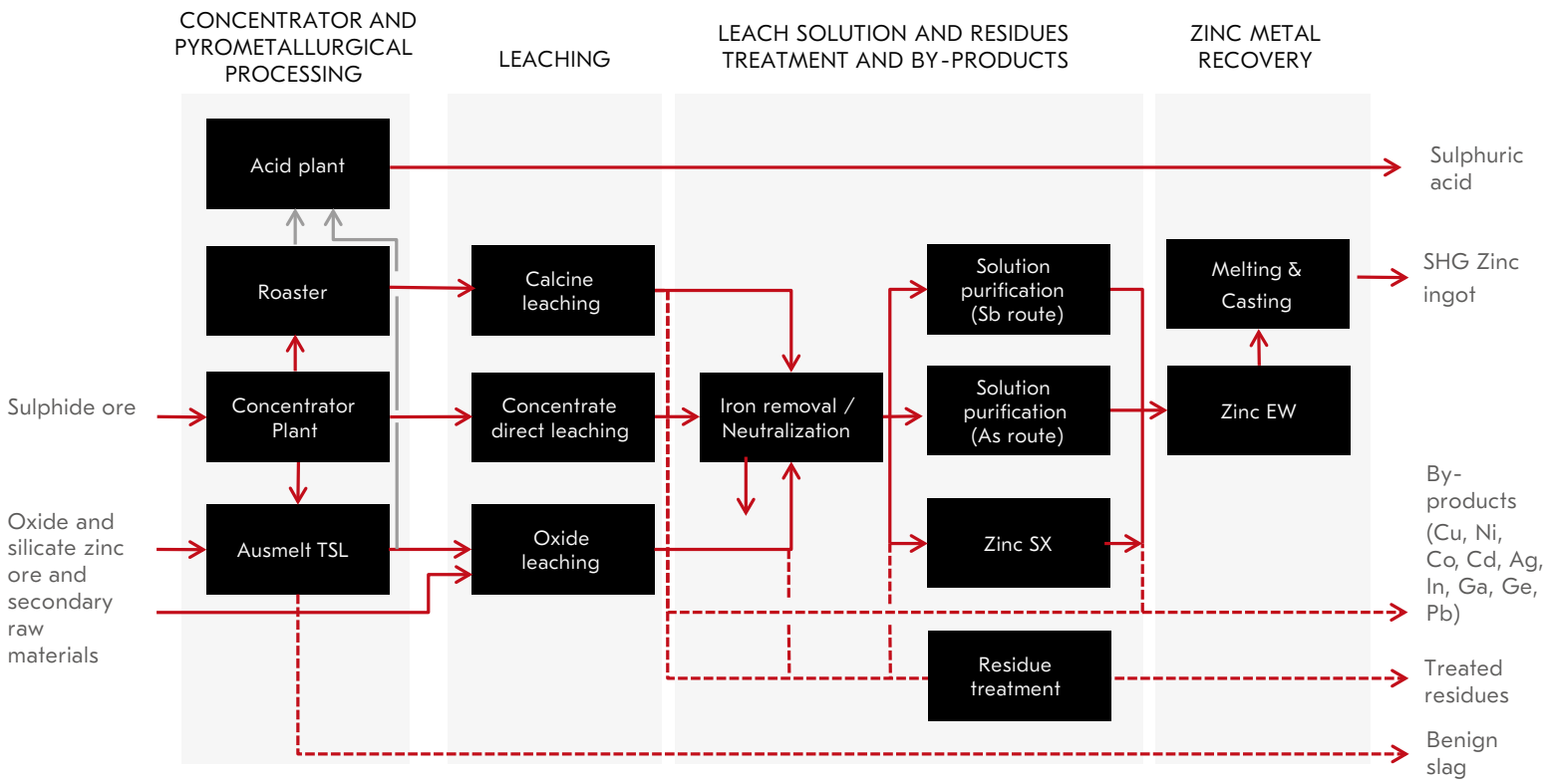
From raw materials to end products

Metso Outotec is the only technology provider who can offer technology and equipment for the whole production chain from the mine to metal with project scope ranging from equipment packages to complete turnkey delivery.

We have several process options, such as roasting as well as direct leaching of zinc concentrates, and with our broad metallurgical knowledge we can offer customers optimized and reliable process design based on their particular raw materials and customer project requirements. For processing secondary zinc material or low grade concentrates, Ausmelt TSL and related hydrometallurgical zinc fume oxide treatment is an attractive option.

Tailor-made solutions and process guarantees through metallurgical testing

At the start of each project, we test our customers' raw materials and feedstock and tailor our processes accordingly. Metso Outotec's in-house research centers have a unique set of research facilities and pilot plants, from test bench to industrial scale, well-equipped laboratories and an extensive network of research subcontractors. Laboratory testing of mineralogy and chemistry of raw materials, and for example the solid-liquid separation properties of slurries, enable us to define optimized production processes and equipment, as well as optimal bleed treatment and impurity handling processes. Good references, laboratory testing and process simulation - the Metso Outotec way of working - give you the benefit of an optimized process with process guarantees.



Metso Outotec zinc technologies:

Beneficiation:
- Concentrator plant
- Re-grinding
- Raw material handling processes

Leaching:
- Atmospheric direct leaching of zinc concentrate
- Zinc calcine leaching
- Zinc silicate leaching
- Leaching of zinc oxides and secondary raw materials, e.g. EAF dusts

Solution purification and by-products:
- Iron precipitation as jarosite or goethite
- Neutralization
- Pure Jarosite process for maximising silver and lead recovery
- Copper removal
- Chloride removal
- Cobalt and nickel removal – arsenic or antimony process
- Cadmium removal and refining
- Indium, gallium and germanium recovery
- Zinc solvent extraction
- Gypsum removal
- Iron residue stabilization

Zinc recovery:
- Electrowinning
- Melting and casting

Roasting with Metso Outotec Fluidized Bed technology
Metso Outotec Sulfuric Acid Plants
Effluent treatment
Services
Metso Outotec Process Equipment
Metso Outotec Process Automation and Analyzers
Metso Outotec Ausmelt Top Submerged Lancing (TSL) technology

Metso Outotec Hydrometallurgical Equipment:
- Metso Outotec OKTOP Reactors for atmospheric and pressure leaching
- Metso Outotec Thickeners
- Metso Outotec Larox Filters
- Metso Outotec Scrubbers
- Metso Outotec Cooling Towers
- Metso Outotec VSF Solvent Extraction
- Metso Outotec Tankhouse Equipment
- Metso Outotec TankCell Flotation Machines
- Courier and OTI Analyzers
- PROSCON Process Control System
- Process instruments and electrificatio

Efficient and reliable leaching methods

Atmospheric direct leaching of zinc concentrate

Metso Outotec has a proprietary leaching method for zinc concentrate. This highly cost-effective and environmentally friendly process has been proven on an industrial scale at several zinc plants. The zinc concentrate is leached in sulfuric acid, either co- or counter-currently. OKTOP 9000 Direct Leaching Reactors provide the essential dispersion of oxygen and slurry required for the related reactions. Online process control with Metso Outotec OTI Titrators and Courier Analyzer guarantees reliable and smooth operation. The process is extremely flexible with respect to different raw materials and variations of feed materials. By using Metso Outotec atmospheric direct leaching, zinc recovery exceeds the industry norm.

Atmospheric direct leaching can easily be constructed to be standalone or combined with calcine leaching. The iron can be removed as jarosite or goethite. As a result of the precise control of iron oxidation and the acidity of the process solution, iron precipitation is carried out either during or after the leaching process, depending on the needs of the customer.

Zinc calcine leaching

Zinc calcine produced in roasting contains zinc oxide and zinc ferrite. In order to obtain the maximum amount of high-quality zinc, the two must be leached in different conditions. Firstly, zinc oxides are leached in neutral leaching stages, during which ferrites do not dissolve. The residue of neutral leaching is led to the second leaching stage, which uses higher acidity and temperature. For this step, Metso Outotec has two options.

If the lead and silver content of the zinc calcine is high, the residue of neutral leaching can be leached in the Metso Outotec hot acid leaching process. The incoming zinc ferrite is leached, guaranteeing an overall high level of zinc recovery. A leaching by-product is produced simultaneously with the highest possible lead and silver content. The silver can then be further recovered as silver concentrate using Metso Outotec flotation technology.

For low lead and silver content, the Metso Outotec conversion process can be utilized. In this process, the zinc ferrites are leached simultaneously with the precipitation of jarosite.

Leaching of zinc oxides and secondary zinc raw materials

Processing of secondary zinc raw materials and recycling of zinc are increasingly important. Metso Outotec has designed a hydrometallurgical process to produce Special High Grade zinc from fume oxides of e.g. Ausmelt TSL and Waelz furnaces. The process includes washing and leaching stages and, in case of raw materials with high chloride and fluoride content, Metso Outotec VSF zinc solvent extraction is used before the electrowinning. By-products such as indium and germanium can be recovered by integrating solvent extraction steps in the leaching circuit. We offer various methods to control impurity levels in the solution to guarantee trouble-free operation and to meet even the strictest environmental regulations for process outlet streams.

Metso Outotec know-how in the leaching and solvent extraction processes combined with our process equipment and optimized equipment material selection ensures high performance and cost efficiency.

Zinc silicates leaching

Metso Outotec has also developed a leaching process for zinc silicate and zinc carbonate ores. Special attention is paid in the design process to the solubility and kinetics of silicates, which offers high zinc recovery, efficient solid-liquid separation and stable process operation. In addition, our tailor-made process solution enables acid consumption to be optimized in leaching and to make processing of this kind of raw material economically viable.

Extensive portfolio of advanced solution purification and metals recovery

We offer an extensive selection of solution purification processes. During leaching, other metallic components in addition to zinc, such as iron, indium, copper, cobalt, nickel and cadmium, are leached and must be removed before electrowinning. The most valuable of these metals can be recovered as by-products. Our famous Metso Outotec VSF Solvent Extraction is an attractive option for diluted solutions with high amounts of chlorides and fluorides.

Iron removal

Metso Outotec jarosite and goethite processes have been proven to produce iron precipitate with low zinc and high iron content. Our expertise in iron precipitation offers zinc producers an efficient and reliable solution and iron residue stabilization for environmentally acceptable iron residue storage or further use. Metso Outotec Pure Jarosite Process eliminates the need for neutralization by calcine in jarosite precipitation and thus minimizes losses of silver and lead to iron residue.

Neutralization and hydroxide precipitation

Metso Outotec provides expert solutions for removing metals from dilute process solutions, e.g. bleed streams. Neutralization is performed through the addition of lime milk; the metals in the solution are precipitated as hydroxides. The combination of three factors,
pH control, powerful OKTOP Reactors and Agitators, and seed circulation, makes the Metso Outotec neutralization plant superior to our competitors.

Copper removal

The first stage of solution purification is copper removal. Copper is cemented using zinc dust, and cuprous oxide is produced, reducing zinc dust consumption and thus operating costs. The copper cake can be utilized as a raw material in copper smelting processes.

Chloride removal

If high chloride content raw materials lead to high chloride concentration in the leaching solution, chloride removal can be implemented at the copper removal stage. Chloride removal minimizes corrosion problems and improves working conditions at the cellhouse.

Cobalt and nickel removal

After copper and chloride removal, cobalt and nickel are removed through Metso Outotec's continuous arsenic process, through the addition of arsenic trioxide and zinc dust. The cobalt and nickel removal process using arsenic has low zinc dust consumption, a high-quality product solution and the ability to treat solutions with high impurity levels. In addition, Metso Outotec has provided antimony-based purification processes all over the world and has vast experience in this field. Cadmium, cobalt and nickel are precipitated using antimony chemical and zinc dust.

Cadmium removal

After arsenic-based removal of cobalt and nickel, cadmium is removed using Metso Outotec's state-of-the-art fluidized bed system, which gives the lowest possible zinc dust consumption and produces cadmium sponge with high cadmium and low zinc content.

Gypsum removal

The calcium content of the zinc solution must be lowered prior to electrowinning to minimize scaling. Gypsum removal is performed by cooling the solution with Metso Outotec Cooling Towers, and by separating the precipitate from the main zinc solution using Metso Outotec High Rate Thickeners.

Indium-gallium-germanium recovery

Recovery of indium, gallium and germanium is beneficial for certain zinc raw materials and zinc production processes. Metso Outotec has the technology to recover these elements and can tailor economical processes based on customer needs.

Zinc solvent extraction

Metso Outotec is the world-leading supplier of solvent extraction technologies. Solvent extraction is an appropriate method for zinc plant solution purification for diluted solutions produced when leaching secondary zinc raw materials and for process solutions containing high amounts of chlorides and fluorides. Metso Outotec's ground-breaking VSF solvent extraction technology is especially well-known at copper plants. It enables minimal entrainment levels without compromising reaction and settling rates.

Efficient electrowinning with jumbo cathodes

Metso Outotec is the right partner for delivering an efficient, productive and safe electrowinning plant with optimized cathode and cell sizes, current densities, busbars, and an automatic material flow of cathodes. Metso Outotec has vast experience in supplying zinc electrolysis processes and equipment for greenfield plants and modernizations, based on its own process knowledge, continuous R&D and technology.

The material management system, with key equipment such as automatic cathode stripping machines, anode washing/ flattening machines and cellhouse cranes, ensures a safe flow of material and the smooth harvesting of cathodes with minimum labor. The full line of automated equipment reduces human exposure to molten metal.

Zinc melting and casting

Zinc cathodes are melted and cast into zinc slabs or jumbo ingots. Molten zinc can also be alloyed in holding furnaces to achieve special final products. The fully automatic Metso Outotec Ingot and Jumbo Casting Machines allow you to run the casting plant 24 hours a day, seven days a week. We also offer solutions for dross treatment and zinc dust production.

Metso Outotec is a frontrunner in sustainable technologies, end-to-end solutions and services for the aggregates, minerals processing and metals refining industries globally. By improving our customers' energy and water efficiency, increasing their productivity, and reducing environmental risks with our product and process expertise, we are the **partner for positive change.**

Metso Outotec Corporation, PO Box 1220, FI-00101 Helsinki, Finland
tel. +358 20 484 100, fax +358 20 484 101
mogroup.com

Partner for positive change